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EXPERIMENTAL INTERFERENCE WITH REALITY CONTACT (PERCEPTUAL ISOLATION): METHOD AND GROUP RESULTS[1]

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The phenomena produced in normal human adults by perceptual isolation—that is, by minimizing perceptual contact with significant aspects of reality—have attracted wide interest although few studies have as yet been published. Our own approach to the phenomena has been to study and predict individual differences in the tendency to react to perceptual isolation by disturbances in thought and affect; these findings are reported elsewhere (4, 5). We thought it desirable to describe here the general reactions of subjects to our particular technique of isolation, since they contribute a number of interesting points to a field in which so little is known.

Our study was conceived in a psychoanalytic framework, which will become apparent in the choice of concepts to express some of the findings. There is value, we judge, in adopting Freud's concepts of primary and secondary process, as rough first approximations, to refer to regressive and mature types of mental functioning. We shall, however, reserve a full discussion of the theory and the relevance of our data to it for another place.

PROCEDURE

The subjects (Ss) were 14 male freshmen in the New York University School of Education. The administration of the school kindly made available the test scores of students who entered in the fall of 1956, who had been given the Ohio State Psychological Examination (a group test of intelligence) and the Minnesota Multiphasic Personality Inventory. A letter of invitation to participate was sent to all students who met the following criteria: they scored at the 40th percentile of college students or higher on the Ohio, and they had no T-scores in the pathological range (above 71) on any of the MMPI scales.[3] The letter stated that a study of superior students was under way, and that they had been chosen for their outstanding intellect and emotional stability. They were then asked by telephone to come in for an interview, when the entire research program was explained. They were told that they would be paid $1.00 per hour, that a total of about 50 hours would be required over the course of the school year, and that on one occasion they would be asked to devote an entire day to an "experiment in which you'll be asked to do nothing." This was the only reference to the isolation experiment.

On the basis of this interview, several potential Ss whose interest was weak, whose schedules were too full or whose personal adjustment seemed fragile were discouraged; others removed themselves from consideration, so that in the end only 15 male Ss met the criteria of interest, intelligence and apparent stability. All Ss were given

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[3] Exceptions were made for 5 Ss who had a single T-score as high as 76 in a generally non-pathological configuration.

a Rorschach on one of their first appointments at the Research Center; one more S was excluded from the present study because his Rorschach performance suggested severe maladjustment. The screening was rigorous enough so that no S was seriously disturbed by participation in the experiment, although one of those who stayed the entire eight hours underwent a personal crisis several months afterwards, with considerable decompensation. This seemed to be in no way connected with his participation in the experiment.

In the course of the school year, each S took part in a number of other experiments, and was given numerous tests of personality, cognitive style, and various other functions. The isolation experiment was scheduled early in the series for as many Ss as possible, as soon as they had taken the Rorschach. It was conducted in two sessions.

SESSION I (PRE-ISOLATION TESTING)

Each S was pretested on a battery of cognitive tests two or three weeks before the isolation session proper.[4] The test battery consisted of subtest 5 (Arithmetic Reasoning) of the Otis Group Intelligence Scale, the Digit Span subtests of the Wechsler-Bellevue Intelligence Scale, the Story Recall subtest of the Babcock Test battery and subtest 3 (Logical Deductions) of the Watson-Glaser Critical Thinking Appraisal. An alternate form of each of the above tests was administered at the end of the isolation session to determine the presence of cognitive impairment. In order to make the testing conditions comparable the pre-isolation testing was conducted in exactly the same manner as the post-isolation testing (*i.e.*, the tests given at the end of or immediately after the isolation session): Ss were led into the isolation room blindfolded; they were asked to lie down on a couch and were tested over an intercom system (except for the written Logical Deductions test which in both sessions was administered in an adjoining room under normal testing conditions).

[4] The Ss were also given the following tasks a few weeks before and again at the end of isolation: Word Association Test, Controlled Associations, Figure Drawings, Fantastic Animal Drawing, and Time Judgments. In addition, each S was interviewed in Session I to obtain information about his general degree of activity, sociability, and susceptibility to boredom. The results of these procedures are not included here.

DESCRIPTION OF ISOLATION ROOM AND APPARATUS

The isolation room is depicted in Figure 1. In length the room measures 14 feet, in width seven feet and in height ten feet. The room contains two windows which have been boarded up with sound-insulating material. To some extent this dampens noises from the street, but it does not prevent the transmission of the sounds of heavy trucks and the sounds of heavy footsteps from the hall. In order to curtail these sounds as much as possible, and to increase the homogeneity of external stimulation, a constant masking "white" noise was fed into S's ears via the earphones. This was done with a Random Noise Generator, range: 20 kc, maintained at an output voltage of 1. During the entire isolation session one light was kept on (300 W, 120 V, frosted). The lamp is in a fixture suspended from the ceiling, surrounded by a wide reflector and located about six feet from S's face. A one-way mirror, inserted in the wall separating the isolation room from the adjoining room enabled the experimenter (E) to observe S and to keep a record of his motor activity. The S's verbal output was recorded on magnetic tape.

SESSION II (ISOLATION)

The S was told only that the experiment would take all day, that he was to arrive at 9 A.M. and not to expect to be through until 8 P.M. Upon his arrival, he received the following instructions:

> "Today's experiment is one in doing nothing. You will be taken to another room where you'll be asked to lie down on a comfortable couch.

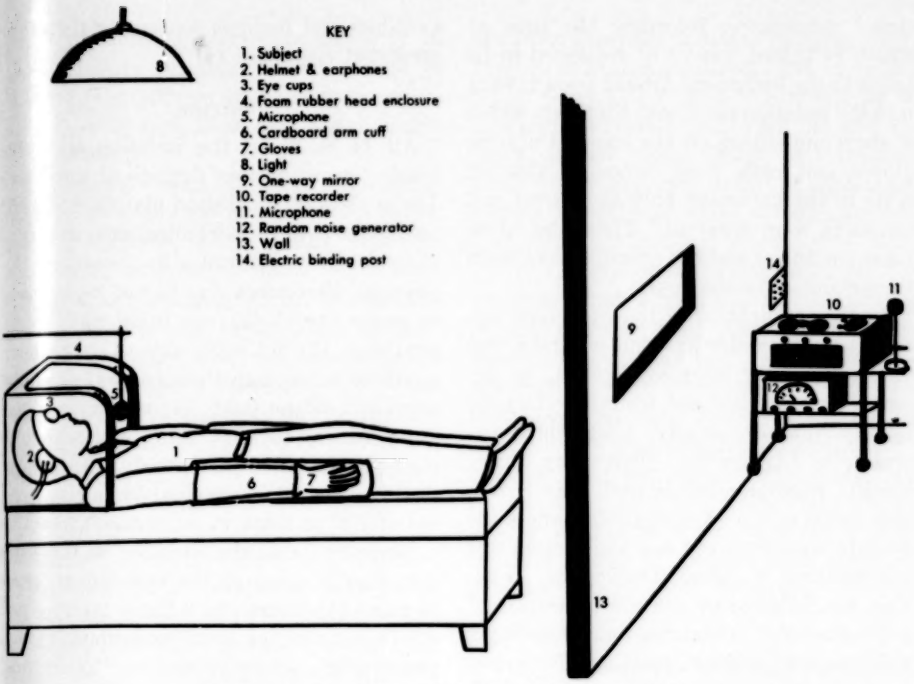

FIG. 1. Isolation room and apparatus described in text.

your eyes will be covered by these eyecups, made from ping-pong balls, which I will glue on with some harmless adhesive. You'll be wearing some gloves and some cuffs, which to some extent will hamper your motions, but will allow you to flex your arms when necessary. Try not to move any part of your body unless you find it absolutely necessary. You will be all alone in the room, but I will be in attendance all the time and will be in contact with you over an intercom system. You can talk at any time you wish, but I won't answer unless it's essential. I want you to talk about the thoughts that go through your mind, the feelings you are experiencing and anything else you want to talk about.[5] If you want to go to the bathroom, just say the word 'bathroom' and I will take you there. If for some reason you want to stop the experiment just let me know, but try to stick it out. I will bring you some lunch and would like for you to tell me now what you'd like to eat. (E writes down the subject's lunch order.) During lunch you will be permitted to smoke a cigarette. Well, how do you feel about it? Do you have any questions?"

A pair of eyecups cut from translucent white plastic ping-pong balls (modified from Hochberg's design (6) and used instead of goggles because they afford greater homogeneity of the visual field) were affixed with easily removable rubber cement around the sockets of the eyes, allowing the lids to open and close. The S was then led into the isolation room, where the gloves, the cuffs and an Air Force helmet containing a pair of cushioned earphones were put on him; it was explained to him that there would be a constant noise emanating from the earphones. He was then asked to lie down on the couch with his head enclosed in a hollowed-out foam rubber pillow. The intercom system was briefly tested, the Random Noise Generator turned on, and the isolation session commenced.

During the eight hours, an E was in con-

[5] The Ss were also instructed that if they talked just for the sake of talking they would receive a signal (two taps over the earphones) to stop it. They might, however, continue to report on their thoughts and feelings. Another signal (one tap) was used to instruct Ss to report their thoughts and feelings if they were remiss in doing so on their own accord. These signals were pretested so that the Ss were familiar with them.

tinual attendance, recording the time at which Ss talked, moved or requested to be taken to the bathroom. Around noon E went into the isolation room with S's lunch, which S ate while sitting on the couch. Only his gloves and cuffs were removed. Also on trips to the bathroom only the gloves and the cuffs were removed.[6] Thus, the white noise continued and the eyecups were worn throughout the eight hours.

At the termination of the eight hour period the white noise was shut off and S was asked, over the intercom system, to describe his thoughts and feelings, which he usually did very briefly, after which the oral tests (Arithmetic, Digit Span, Story Recall) were re-administered. The S was then taken to the adjoining room where the eyecups were removed and the written test administered (Logical Deductions Test). This was followed by the administration of a questionnaire, containing items covering a wide range of possible isolation effects, and a relatively unstructured interview, both dealing with S's isolation experience; his responses to the questionnaire were discussed and clarified. Finally, he was asked for a retrospective account of his experience, to be written preferably on the following day so that longer-lasting post-isolation effects could be included.

Using the typed transcripts of the Ss' verbalization during isolation and subsequent interview, we independently ranked the Ss on a number of pre-established variables. The list of variables on which Ss were ranked include the following: unpleasant affect, pleasant affect, stimulus-bound thought, free secondary process thought, impaired secondary process thought, controlled use of promary process, poorly controlled use of primary process, imagery, self-stimulation, immobility, quitting, verbal output, sleep, cognitive test impairment, and general disturbance. Definitions of these variables and findings concerning them are presented elsewhere (4).

[6] The wire connecting the white noise generator with S's earphones was long enough to permit S to go to the bathroom without terminating the white noise.

RESULTS

All 14 Ss found the isolation situation *frustrating* to various degrees of intensity. The sources of frustration may be grouped, on the basis of Ss' verbalizations, as stemming from the following five sources: (1) physical discomfort due to not being able to move freely; (2) not being able to *do* anything; (3) not being able to see or hear anything other than the meaningless white noise and diffuse light; (4) not being given a sufficient frame of reference with which to meet the situation, particularly with regard to time; and (5) a gradual impairment in the ability to think in a "normal" way.

Three Ss found the situation so stressful that they terminated the experiment after 50 min., 1½ hours and 3 hours 20 min. respectively. One of them exclaimed, "Boy, you couldn't get me to stay any longer unless you held a gun over me!" Other Ss gave vent to equally strong sentiments. Eight more Ss indicated, at various points in the experiment, a preoccupation with quitting, while the remaining three Ss denied having thought about quitting. The major reasons given for *not* quitting were: (1) a sense of commitment or duty to see it through; (2) wanting to prove, either to themselves or to E, that they could "take it"; and (3) somehow not being able to put the desire to quit into action.

When asked, at the end of the experiment, whether they would be willing to repeat the experiment some time in the future, ten Ss responded negatively, while the remaining four answered with a hesitant, qualified "yes" (*e.g.*, "I guess I would if it will help you"; "It might be easier next time, but I certainly wouldn't look forward to it.")

AFFECTIVE REACTIONS

All Ss experienced some form of unpleasant affect, while some of them also experi-

enced pleasurable affect. The intensity of their affective reactions varied enough so that we (the authors, acting as independent judges) could rank them with a high degree of agreement.

Unpleasant affect occurred most frequently with the experience of: restlessness, tension; boredom, ennui, apathy; irritability, disgust, annoyance, diffuse anger; anxiety, fear of "going nuts" or "losing control"; inability to engage in "normal" thought activities and the emergence of unwanted thoughts, fantasies, daydreams and highly vivid imagery; and suspiciousness, depression, fatigue, loss of time-orientation.

Unpleasant affect was also associated with the experience of bodily pain—notably backaches, muscular aches and stiffness. About half of the Ss reported such pains. On the questionnaire administered at the end of isolation, eight Ss indicated that they found the helmet annoying (it pressed against the ears or was found too warm), two Ss indicated that the cuffs were slightly annoying, one complained that the eyecups bothered him, and one reported that the gloves were uncomfortable. Six Ss found the constant white noise slightly annoying, especially in the beginning, while four Ss reported that it generally "faded away."

Although, taken as a whole, the isolation experience may be characterized as primarily unpleasant, nine Ss did report pleasurable affect at some point in their experience. These reports were generally made at the outset of isolation, when Ss would indicate feeling "relaxed," "comfortable" and "happy to get away from it all." Some also reported pleasant affect accompanying thoughts about incidents of the past, daydreams and the spontaneous appearance of highly vivid imagery. In five Ss positive affect persisted, off and on, throughout the eight hours. For the group as a whole, however, it was generally supplanted by the upsurge of more intense unpleasant affect.

At the termination of isolation, unpleasant affect generally subsided rather quickly. Most Ss indicated great relief and expressed joy at being able to talk to someone, to be "back in the world" and to see life and activity around them. Many Ss retrospectively denied or played down the unpleasant aspects of their experience, or indicated that they did not remember exactly what they felt or thought about during isolation. On the other hand, a couple of taciturn Ss expressed more of what they felt in retrospective reports than they did in spontaneous remarks. This observation, in addition to the fact that many Ss displayed evidence of heightened suggestibility during the post-isolation interview, suggests that if one had to rely solely on retrospective data a misleading picture of what happened during isolation would be gained. Both types of data are indispensable, therefore.

THOUGHT PROCESSES

There were marked individual differences in the relative emphasis of a particular type of thinking engaged in by Ss. Some Ss (three in particular) persisted hour after hour in stimulus-bound thinking (that is to say, thought devoted to the immediate experimental situation and relatively direct associations to it), as if afraid to "let go" of external reality. They reported such thoughts as:

"I'm trying to figure out the physical layout of the room."

"I'm again wondering what the purpose of this experiment is."

"I was thinking how silly I must look in this outfit."

"I'm wondering whether I'm being watched ... and what you are doing all this time."

"I'm trying to associate to the noises I hear."

"I have been thinking about a book on solitary confinement I recently read."

"I was thinking how terrible it must be to be blind or to be forced to lie on one's back for a long time."

"I'm wondering what the cuffs are made of."

Other Ss, although they occasionally engaged in such stimulus-bound thinking, showed a greater frequency of reports reflecting *free secondary process* thinking (that is to say, thinking devoted to rational, relatively sustained reflection pertaining to any topic other than the immediate experimental situation or relatively direct associations to the situation). They thought about friends, plans for the future, books, movies, schoolwork, etc. Or they engaged in time-passing games; for example, one S amused himself for about an hour by thinking of the names of composers in alphabetical order.

Whether they engaged primarily in stimulus-bound thinking or free secondary process thinking, at some point in the isolation period all Ss experienced thought disturbances of various kinds. They increasingly complained of an inability to think "normally" with accustomed ease and efficiency. Some Ss reported experiencing a paucity of thoughts; they exerted great effort in thinking "about things to think about," and claimed their minds went "blank" or "white" as one S put it. Other Ss experienced an inability to think about anything "important" or "serious," and an inability to concentrate on any one topic for very long. These thought disturbances are exemplified by the following characteristic reports:

"Thoughts are just hopping around now, there is no order."

"A lot of little things keep popping in and out."

"My mind keeps skipping from one thought to the next, I can't stick with anything."

"I feel less intelligent now."

"I couldn't think of one thing long at all, just little bits of things."

"My mind has become very distractable, any sound sets me off."

Some Ss gradually drifted into a fluid, aimless, "involuntary" mode of thought, characteristic of the primary process. Regression to the primary process mode of functioning was also evidenced by reports of fleeting fantasies, daydreams, drive-dominated thinking and by reports of thoughts that Ss were "too embarrassed" to divulge. It was further reflected in the appearance in seven Ss, of difficulty in differentiating clearly between states of consciousness, as exemplified by the following reports: "I didn't know whether I was asleep or awake or where I was"; "I'm not sure whether I dreamed or whether I was awake"; "I dreamed I was at the Research Center and that all this was a dream, but one touch on those cuffs made me realize it was not just a dream."

Although all Ss experienced difficulty in maintaining secondary process functioning, they did not all regress to the same degree. The situation left them several other options:

1. They could terminate the experiment, which three Ss in fact did.

2. They could sleep, which most Ss did in varying amounts, *viz.*:

Amount of Sleep (*Computed per hour*)	*No. of Ss*
0 minutes	3
1–15 "	4
16–30 "	4
31–45 "	3

3. They could focus on the residual external stimuli or create stimulation by such means as singing, tapping the cuffs, changing body position (although they were asked to inhibit this as much as possible), exploring the surroundings with their cuffs and legs, and, within the limits set by the instructions, by talking. One or more of these devices were employed in varying degrees by all Ss.

4. They could use various supports to help keep their thoughts rational or at least organized: counting, going through a manual of arms, playing alphabetical games or otherwise staying within the framework of

an overlearned series or outline (used by six Ss); reciting poetry, singing internally, reviewing movies or fiction—relying on a structure of a more complex kind that was in the beginning external and now preserved in memory traces (ten Ss); or by creative activity, such as composing poetry, creating designs or even making jokes (three Ss)—that is, meeting the primary process head on, so to speak, and making constructive use of it instead of trying to avoid it.

IMAGERY

Nine Ss reported the spontaneous occurrence of visual imagery, often described as being quite different from what they might usually experience in the normal, waking state. These images were unusual in their sudden, spontaneous appearance, their vividness and, in some instances, their "meaningless" content. Although most of the time all Ss were aware of the subjective nature of the images, some images were described, by four Ss, as if they were external percepts. One S at times confused them with dream-images. Conceptually the phenomena reported might best be described as hypnagogic imagery, since the images generally occurred in a drowsy, sleep-like state of consciousness. The following are examples of the kind of visual imagery reported:

"For some reason I just imagined seeing a subway train."

"I saw a little scene, looked like children playing. One pushed another into the water, then the one got up and pushed the other in."

"One time I saw somebody, I don't know what, I can't remember ... it was something like a laughing animal or something ... it just stood there and disappeared ... it looked like a prehistoric animal."

"I see millions of small umbrellas in a deep purple shade I've never seen before."

"I got a picture of flowers, rows and rows of pink and red roses, very beautiful."

"I just got a picture of some sort of ancient arch, marbled, huge arch ... skyscrapers spring up in front of it and are blocking off its view."

"I just saw like saran wrap and someone holding it up and it was perfectly translucent ... I saw the tips of the fingers."

"I was just thinking about a movie I saw last night on TV, when I actually saw visions of the actual scenes."

Auditory imagery was reported by seven Ss. Some of it was instigated by the white noise: "It sounds like the seacoast, I heard several sounds like it, it wasn't exactly the same, but I pretended I was on the beach and the noise just seemed to blend in after that"; "It sounds like the surf pounding against rocks"; "I listened to the noise and in my mind I imagined hearing music." Other auditory imagery, apparently unrelated to the white noise, occurred quite spontaneously and in several instances reached hallucinatory proportions: "I wonder if I really heard someone sing? It sounds like Gladys Gooding singing Star Spangled Banner" (In the post-isolation interview this S said: "One time I heard a woman singing, uh, I *thought* I heard a woman singing"); "What did you say? ... Did you say something?" (This S mistakenly thought E had spoken to him over the intercom). Other examples of auditory imagery follow:

"For awhile there I heard the music from My Fair Lady ... it's been on my mind ever since I saw it and it suddenly came to me while lying there"; "I heard dull sounds of an object hitting something, it had a musical quality"; "I thought I heard, er, a sort of whistling noise, it wasn't the sound from the helmet or the mike"; "A tune keeps ringing in my er ... keeps being repeated in my mind and that's the song Cindy ...."

TIME-ORIENTATION

All Ss, with the exception of the one who terminated the experiment after 50 minutes, experienced a substantial loss in time-orientation during the session. Reports like "I have no relation to time," "I wonder how

long I have been here," "I'm trying to figure out logically what time it is, but can't," were frequent. All Ss reported that time seemed to be passing very slowly. One might therefore expect them all to *overestimate* the passing of time. When confronted with the task of guessing how long they had actually been in the room, however, near the termination of isolation, two Ss were quite accurate, while the remaining ten Ss judged the elapsed time with an average error of only one hour and 17 minutes, in the consistent direction of *underestimation*. One S said: "I feel I have been here a million years"; he quit after an hour and a half, and was one of the two who guessed the time with negligible error. This finding points up the subtle and tricky nature of time-perception. It shows that the experience of *time in passage* is not to be identified with the usual operation of estimating time, which in some Ss, at least, may be a relatively autonomous cognitive act. In evaluating the relatively accurate time estimates given by the Ss, it must be remembered that they did have an important, objective cue available; namely, the knowledge that the experiment would last at the most only one day. The interruption for lunch may have also served a general orienting purpose.

BODY IMAGE DISTURBANCE

Three Ss reported phenomena classifiable under the general heading of body image disturbances. One reported experiences of total body movement: "I felt I was moving, especially when I would see an image, it would come racing towards me." A second reported that "my head feels like it weighed a ton." The third's comments are more questionably classifiable under this heading, but signify changed bodily sensations: he felt a "roaring" in his head, and also reported that he felt "lightheaded."

DEPERSONALIZATION

Three Ss showed evidence of depersonalization. They made the following reports: "I feel indifferent, like I'm not here ... like I'm floating on air ... as if it's all a dream"; "I feel indifferent, like I don't care what happens"; "I felt I wasn't there ... I don't feel anything."

DREAMS

Seven Ss reported with certainty the occurrence of dreams during isolation. One S was unable to recall what his isolation dream was about, another S remembered only that it had to do with a shark. Three Ss reported dreams which involved the isolation situation directly or incorporated aspects of it. For example, one S dreamt that he hit somebody with a "tube"; another S dreamt that the experimenter was "doing things" to him, giving him electric shocks, attempting to hypnotize him. He also dreamt that he was being an "inadequate subject," that he was pushing the bed away from the wall, etc. This S later reported that when he woke up he was so angry with the experimenter that "I could have killed you." Finally, one S had a blatant sex dream, which he described as unusual in that "it seemed real, it was a funny sensation, it was as if it really happened." The dreams experienced during isolation were generally ascribed a vivid, "realistic" quality, by all Ss.

In addition, two Ss reported dreams from the night following isolation. One of them wrote in his retrospective report: "In this dream I relived the more horrible aspects of my time in the isolation room. I felt as if the room were a living thing, as if it were closing in on me, and I was tied down, unable to escape." The other S's dream contained the themes of being trapped, challenged and of trying unsuccessfully to escape a barrier.

POST-ISOLATION EFFECTS

Ss varied markedly in the effects shown following isolation. Two Ss showed hardly any disturbance; seven Ss reported feeling "dazed," "disorganized," "groggy," "dizzy" or "unstable"; eight Ss indicated that they

felt tired (one S, although he had planned to go out on a date, went home to bed instead; another said that "even talking is a great effort"); four Ss reported some form of motivational disturbance: "I'm completely disinterested in everything, even my own thoughts," "I have lost all my ambition." "I don't give a damn for nothing," "I don't have the get up and go." One S, when asked what he planned to do once he left the Research Center, said: "I don't know ... I'll flip a coin." Four Ss manifested a kind of "stickiness" in their relationship to E in the post-isolation session. They were somehow unable to terminate the relationship despite their expressed impatience to leave and despite E's wish to get away too. After being told, "We are finished now, thank you very much for your cooperation...." they would remain seated and try to engage E in conversation, not necessarily about their isolation experience, but apparently about anything that might serve as a means to delay their departure.

MISCELLANEOUS OBSERVATIONS

Three Ss reported changes in their usual voice quality and speech; they felt their speech was retarded or had a monotone, colorless quality. Two Ss complained of an increasing difficulty in expressing themselves verbally, being somehow unable to exert the necessary effort involved. One S expressed a general reluctance to speak during isolation, since he thought it "foolish" to talk about every thought and feeling he was experiencing. Another S expressed the idea that it was difficult to talk after awhile because of the one-sidedness of the "conversation."

Immediately following isolation when requested to draw a person, one S reported that his hands were unstable, while another S said, only half kiddingly: "I don't even remember what people look like any more."

Although Ss were isolated from *direct* social contacts, a few offered evidence suggesting that they perceived the experimental situation as essentially an interpersonal one (as would be expected). One S, for example, after requesting a drink of water, became intensely angry with E because of a slight delay in responding to his request. He reported (in the retrospective written account) the following thoughts: "Why the hell don't he bring me a drink ... I bet he isn't even out there. I bet I've been laying here like for hours, like an idiot, and nobody was even listening. I don't mind going through this stuff, but somebody should at least be interested ... if nobody is out there I might just as well rip these silly goggles off and go home...." (Incidentally, the thought of being abandoned was also voiced by another S.)

Another S stated that the situation "got to be like a game to see who could outwit who." (This S was referring specifically to an incident during isolation in which one of his cuffs accidentally slipped off his hand. He did not report this, hoping to "put something over" on E.) Another S saw the situation as an endurance contest, staged by E to determine which S would last longest. Yet another S thought that E was interested in learning how resourceful he was. Other indications of the interpersonal nature of the situation may be seen in the attempts, made by two Ss, to engage E in conversation (on trips to the bathroom or when lunch was brought to the room); reports of thoughts involving E; and the concern voiced by one S with what the secretaries would think when they typed his verbalizations.

COGNITIVE TEST PERFORMANCE

In view of the decline in the ability to concentrate and engage in normal, directed thought, reported by all Ss, a general impairment in tests of cognitive functions might be expected. As the results in Table 1 show, however, this was not the case. Except for the test of Logical Deductions, on which a significant proportion of the Ss performed more poorly, there was no general impairment. In fact, on three out of the seven test measures the majority of the Ss

TABLE 1

*Comparison of Pre- and Post-Isolation Scores on Cognitive Tests (N = 12)**

Test variable	Numbers of Subjects with:			
	Impaired Score	Unchanged Score	Improved Score	p†
Logic (error)	9	2	1	<.01
Arithmetic (error)‡	6	0	6	>.05
Arithmetic (time & error)	5	0	7	>.05
Story Recall (no. correct memories)	4	0	8	>.05
Story Recall (weighted error)‡	4	0	8	>.05
Digits Forward	3	4	5	>.05
Digits Backward	3	4	5	>.05

* Two Ss were not tested: one S quit after 50 min. and was generally uncooperative, while the other quit after 3 hr. 20 min. and refused point-blank to take any tests.

† Based on the Sign test.

‡ Since a significant correlation was found between initial and difference scores on these two measures, they were corrected for regression effect.

obtained a better score at the end of the isolation session as compared to their score several weeks before isolation.

Intercorrelation of the impairment scores revealed a lack of intra-individual consistency in performance across the tests. Aside from a spurious correlation obtained between Arithmetic (error) and Arithmetic (time and error), only one out of 20 coefficients—Arithmetic (error) and Logic (error) correlated .51—was statistically significant, a finding that might have been predicted by chance alone. A typical S obtained an impaired score on three test measures, an improved score on three, and an unchanged score on the remaining measures.

Some Ss spontaneously remarked that they felt they did better on the tests for the following reasons: they put more energy into the task, they felt more comfortable with E than they had in the first session, or they welcomed the relief from isolation afforded by the test stimuli. A few Ss reported feeling annoyed by the tests and indicated that they summoned up all the energy at their disposal to "get it over with" as quickly as possible.

DISCUSSION

We want to emphasize, first, the fact that the general effects we observed are the result not solely of perceptual isolation, deprivation or lack of variation, but of the *total* experimental situation we used. Some aspects of our setup are subject to experimental variation, and their contributions could be separated out: the physical discomfort and other effects (such as imagery-promotion; *cf.* Singer (10)) of prolonged immobility; the effects of the posture of lying flat on one's back (*cf.* the use of the couch in psychoanalysis to promote free association, and also the experimental study by Beigel (1)); the unstructured and novel aspects of the situation; and its social aspects resulting from S's knowledge of E's presence and the requirement to talk.

It is not easy to imagine a feasible experimental procedure in which Ss could be convincingly told that they would be abandoned, with no E hovering in attendance. Even if they were shown automatic equipment and were told that it would do everything, they still would have the "audience" of the workers who would eventually transcribe the recording of what they said and did—an audience of which at least one of our Ss was very much aware. And it is clearly impossible to get Ss to stay in for an indefinite period. The knowledge that the experiment will last only so many hours or days, and that it may be terminated at will, undoubtedly does a great deal to make experiments like ours fundamentally different from experiences of castaways, prisoners, or potential space travellers. Isolation that is voluntarily sought out and maintained may have still different effects.

One of the most striking results of the present study as compared to previously reported ones (except that of Lilly, (8)) is the finding that eight hours of isolation is enough to bring about most of the charac-

teristic effects. The fact that three of our 14 Ss quit after from 50 minutes to 3 hours indicates that at least the affective phenomena can become quite intense quickly, and that the length of time is probably less important than the degree to which contact with reality is interrupted and the importance of such interruption to the individual S.

It is interesting that although the McGill investigators found impairment on all tests, the greatest and most significant impairments were found on the post-isolation tests. This was true in our study too, since the Logical Deductions test (the only one significantly impaired) was the only test given immediately following isolation. This finding may however be due to differences in level of difficulty of tests given during and those given after isolation: in both experiments, the tests given after Ss left the isolation room appear to have intrinsically required more sustained effort. Future studies should compare a battery of tests administered during isolation with the same tests or an alternate form of the battery immediately following isolation, to determine whether it is the nature of the tests or the time at which they were given that is the significant factor.

Along with the similarities there are, of course, differences between our findings and those of other investigators. Considering the effects on cognitive test performances, we find agreement between our findings and those of Bexton, Heron and Scott (2) in that our Ss' performances on the Digit Span and Arithmetic tests were not significantly impaired. Perhaps because of the briefer time involved, our findings go further: instead of being generally (though insignificantly) hampered, a majority of our Ss equalled or improved on the preisolation scores on Digit Span, and Arithmetic, both error and time scores. In this respect, they bring to mind Hoffman and Vernon's finding (7) that college students who were kept in isolation, darkness and quiet for 48 hours were better at the rote learning of lists of adjectives during this period than control Ss. Probably any task that can be done satisfactorily in a single brief effort by the use of highly overlearned sets of operations (as in simple arithmetic problems), and any learning or memory performance requiring passive receptivity (*cf.* digit span, rote learning) rather than active reflection and manipulation of ideas (*cf.* logical reasoning) would be least interfered with by moderate amounts of isolation.

Why did we obtain striking effects, such as quitting, marked affective changes, vivid imagery, in such a short period of isolation? The role of solitude per se seems to be negligible in view of the short time involved.[7] Hochberg *et al.* (6) similarly found marked sensory and emotional effects with some Ss in less than an hour of Ganzfeld conditions, with the E present. In that experiment, the only modality interfered with was vision; Ss' eyes were covered by halved ping-pong balls, the eyelashes and lid being held out of the line of vision by rubber cement. Doane (3) similarly found that ambulatory Ss wearing translucent goggles showed the same visual disturbances (including "hallucinations") as quickly as Ss kept in an isolation room with reduced variation in other modalities. Likewise, Ulett *et al.* (11) report very similar phenomena as a result of filling the visual field of Ss with flickering, white light, without any social isolation. So although solitude is undoubtedly an important variable in the experiences of castaways, explorers and the like, we feel safe in assuming it played no appreciable role in our experiment.

If we compare our experimental situation, apparatus, etc., to those reported by others, in relation to the effects reported, we are

[7] In an unpublished study, Stanley Schachter found that periods of up to a week of social isolation undertaken by paid Ss, without any interference with sensory inputs, had no appreciable effects on their thinking or affect. None of his Ss reported anything comparable to the McGill findings.

struck by two facts. First, when total darkness was used Ss reported many fewer changes and less marked effects—especially, less visual imagery—and the phenomena took more time to appear (7, 9). Even the small amount of light admitted by a blindfold can make a decisive difference in the amount of imagery (12). Second, the more complete the establishment of a visual Ganzfeld—a totally homogeneous visual field—the more quickly marked effects were reported. We believe, therefore, that our method worked as well as it did because we used moderate levels of stimulation (rather than seeking the virtually unattainable complete reduction of stimulus level), and because we took pains to make the stimulation constant, unpatterned and homogeneous. We paid particular attention to the eyes, since the visual modality is so important as a medium of contact with reality. Our eyecups probably gave considerably more homogeneous retinal stimulation than the McGill apparatus.

In two respects the visual phenomena reported by our Ss differed from what would have been expected from other experiments. In the McGill experiment, Ss were especially struck by the increased sensory vividness of the visual world when they returned to it after one or more full days of relatively homogeneous stimulation. Colors appeared more saturated, there tended to be a breakdown of some of the constancies, etc. Our Ss made no spontaneous comments of this kind, and their occasional positive replies to questioning are of doubtful significance due to their generally heightened suggestibility after the eight hours. At the same time, they failed to report appreciable visual satiation during the experiment. In the work of Hochberg *et al.* (6), all Ss noted a marked decline in the brightness of the visual Ganzfeld, usually in about 20 minutes. It seems most likely that the fact our Ss could turn their heads and eyes and close their eyelids produced enough unevenness of retinal stimulation from the single light above them to have prevented satiation.

One of the most striking and most widely known phenomena of perceptual isolation is the appearance of *hallucinations*, as they have been called. We believe that the term has caused confusion and has to a degree kept the actual phenomena from being properly recognized. Consider how the term is used in ordinary clinical parlance. We say that a patient hallucinates when he responds to an internally produced image as if it had external reality—as if it were indeed a percept.[8] Notice that there are two quite separate processes involved here: first, there must be an image of as much sensory quality ("impressiveness") as a percept; and second, there must be some failure of reality testing.

On further examination, each of these processes proves to be further divisible. The impressiveness of an image is a function of both its vividness and its structure or differentiation; in many ways, it can be impressive yet also be unrealistic. Also, the longer it lasts, the more impressive it becomes. All of these features may vary independently. Reality testing may fail, and the image be mistaken for reality, in the case of a general weakening of the ego, as in psychosis, drug intoxication or sleep, in which case this function suffers the general fate of many others. The more the ego is weakened, the greater implausibility and unrealism in an hallucination can be tolerated; but note that without any appreciable ego-weakening, a very impressive image may be taken for a percept if it is realistic and plausible. Thus, in our experiment the S who thought he heard the E speak to him

[8] "Hallucination: Perception without external stimulus ... a sensation, implicitly felt by the individual to originate in or from an object in the external environment, but in reality arising within himself."—Blackiston's New Gould Medical Dictionary, 2nd Ed. The same source speaks of the hypnagogic phenomenon as "a pseudo-hallucination, as the subject usually realizes the unreal nature of the perception."

had produced a realistic image (though apparently not particularly vivid or well-structured one, since he didn't "catch what was said") which fit so well into the context that it was easy for him to mistake it for reality.

Because so many independent processes are involved in hallucinations, we propose that it is more useful to consider these components themselves, and when speaking of such a phenomenon, describe its *vividness, structure, persistence, realism,* and the degree to which it would be *plausible* as a percept, as well as the degree to which the S was convinced of its external origin. This last matter is not a simple dichotomy of reality *vs.* fantasy; *cf.* the remarks of the S who thought but was not quite sure that he had heard the national anthem being sung.

Looking at our own data from this standpoint, and also the reports of other experimenters, we offer the generalization that *perceptual isolation primarily tends to increase the vividness (intensity) and structure of imagery*; the prolonged immobilization that it involves undoubtedly plays an important part in this effect. Isolation of eight hours—and probably of no more than a few days—does not seem to produce enough general ego-weakening to undermine the judgmental aspect of reality-testing. Thus, though the McGill Ss often reported vivid and persistent images, colored and moving and occasionally in more than one modality together, in no case did they mistake these "movies" for reality.

In general, also, it seems that there is a tendency for imagery to increase in vividness, structure and persistence (and perhaps to *decrease* in realism) with increasing time spent in isolation, and with increasing monotony or homogeneity of stimulus input. In our findings, imagery was described as vivid but rarely enough so to seem real, regardless of its plausibility, and after no more than eight hours was not as highly organized and persistent as has been reported by McGill Ss after 36 hours, nor as dream-like and autistically elaborated. A pretest subject, however, experienced what meet all criteria of visual and auditory hallucinations in only four hours of isolation under conditions better than we were able to arrange for our experimental Ss. He was in a soundproof room with virtually no intercurrent noise and a much fainter masking noise (no earphones), and with eyelids glued open under the same type of eyecups. He twice thought he heard the E's voice speaking to him, and at one point saw an eye looking directly at him, which he at first took to be a reflection of his own eye on the inner surface of the eyecups. Given the right combination of conditions and subjects, therefore, convincing hallucinations can be obtained from normal Ss in a few hours without resorting to Lilly's (8) immersion technique—the only one hitherto reported to have yielded images of hallucinatory vividness in so short a time.[9]

The S's ego was not weakened, we believe; his reality testing faltered because the images were vivid, persistent, well-structured, realistic, and plausible. The E

[9] In our pretesting, we experimented with a variant of Lilly's procedure. Through the kind collaboration of Dr. Harold G. Wolff and his staff we obtained the use of a therapeutic pool at New York Hospital, which is maintained at physiological zero. With four pretest Ss, we were unable to work out a procedure that allowed the S to relax, breath effortlessly and be free of pain from the breathing apparatus. The rise and fall of the body with inspiration and expiration caused ripples, stimulating the part of the back and shoulders that was above the surface. Even if a method could be devised to keep the S entirely below the surface, this technique would not seem satisfactory because the increased water pressure makes breathing even more difficult and effortful. These experiences make us doubt that the immersion technique produces a marked reduction in the total amount of stimulation; it would seem rather to supply steady inputs (e.g., from the breathing mask) or rhythmic stimulation (e.g., from effortful breathing), thus providing different *kinds* of stimulation from those of the isolation room, rather than quantitatively less input.

could have spoken to him, and though the concave surface of the ping-pong ball could not have reflected an undistorted and easily visible image of the eye even if it had been silvered, the S did not realize that.

Because the plausibility issue is so important with the kind of normal students who have been Ss in most studies, we believe that an image is *less* likely to be mistaken for reality, after a certain point in the first few hours of isolation, the more vivid and elaborated it becomes because the latter is so highly correlated with an increase in unrealism and implausibility. If the S experiences a general, simple change in a visual or auditory quality, for example, like our S who thought that the window was open and it was getting light outside, it is much easier for him to find a realistic explanation for this than if his image is complexly structured and fanciful. Anyone who sees "millions of small umbrellas in a deep purple shade I've never seen before" knows very well that he is imagining them—unless he is psychotic, asleep or the like.

SUMMARY

Fourteen paid college student volunteers spent eight hours lying in a semi-soundproof room, audition and vision being dominated by patternless, steady inputs. Aspects of intelligence as measured by simple auditory tests before and during the last minutes of isolation showed no consistent impairment, but Ss performed significantly worse on more complex reasoning task given immediately after isolation. Spontaneous verbalizations, recorded and analyzed, indicated: a general feeling of decreased efficiency and continuity in thought, affective disturbances—so severe in three cases that these Ss quit in 50 min. to 3⅓ hours, fantasy often with direct drive content, general increase in the vividness and frequency of imagery (visual and auditory), disturbances in the time sense, and miscellaneous other effects reminiscent of the primary process (including depersonalization, body image disturbances and creative activity). Results are interpreted and compared to those of similar studies in terms of the experimental conditions used. The findings suggest a more analytical approach to the phenomenon of hallucination than has hitherto been customary.

REFERENCES

1. Beigel, H. G. The influence of body position on mental processes. J. Clin. Psychol., **8**: 193–199, 1952.
2. Bexton, W. H., Heron, W. and Scott, T. H. Effects of decreased variation in the sensory environment. Canad. J. Psychol., **8**: 70–76, 1954.
3. Doane, B. Changes in visual function with perceptual isolation. Unpublished doctor's dissertation, McGill Univer., 1955.
4. Goldberger, L. Individual differences in the effects of perceptual isolation as related to Rorschach manifestations of the primary process. Unpublished doctor's dissertation, New York Univer., 1958.
5. Goldberger, L. and Holt, R. R. Experimental interference with reality contact (perceptual isolation): Individual differences. Paper read at Symposium on Sensory Deprivation, Boston, June, 1958.
6. Hochberg, J. E., Triebel, W. and Seaman, G. Color adaptation under conditions of homogeneous visual stimulation (Ganzfeld). J. Exp. Psychol., **41**: 153–159, 1951.
7. Hoffman, J. and Vernon, J. Sensory deprivation. Science, **123**: 1074–1075, 1956.
8. Lilly, J. Mental effects of reduction of ordinary levels of physical stimuli on intact, healthy persons. Psychiat. Res. Reports, **5**: 1–9, 1956.
9. Meyers, T. Personal communication, February, 1957.
10. Singer, J. Delayed gratification and ego development. J. Consult. Psychol., **19**: 259–266, 1955.
11. Ulett, G. A. Photically-activated electroencephalogram: research tool in psychiatry. Psychosom. Med., **15**: 66–83, 1953.
12. Vernon, J., McGill, T. E. and Schiffman, H. Visual hallucinations during perceptual isolation. Canad. J. Psychol., **12**: 31–34, 1958.

THE AFFECT SYSTEM: FORESIGHT AND FANTASY

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"The behavioural evidence makes it clear that theory must provide somehow for foresight."
D. O. Hebb (10)

When in 1895 Freud first proposed his concept of primary and secondary thought processes he did so with a neural model in mind (5). The limitations of anatomic and physiologic knowledge of the day, however, did not permit corroboration of his thesis and in subsequent versions (6) he abandoned the anatomical framework, eventually concluding that anatomical correlations were not possible (4). Subsequent conceptualizations were based on a "metapsychological" rather than an anatomic or physiologic framework. Freud felt it to be advantageous to be free of static anatomic restrictions but his decision had the result that much of his theory was not subject to objective testing and proof.

In the course of time the concept of primary and secondary thought processes, though regarded in some quarters as among Freud's greatest contributions, became largely obscured by the later developments of psychoanalytic theory.

To review briefly, Freud's hypothesis stated that, in the mind, there are two distinct organizations which, while they interact with each other, function according to different principles. The first and more primitive organization operates through the medium of affect and imagery according to the pleasure-unpleasure principle, with the development of a "wishful state" in the presence of the experience of unpleasure, bringing into play certain behavioral patterns designed to offset this experience of unpleasure. In this way it provides for the satisfaction of instinctive drives by attaching a pleasurable affective significance to percepts leading to such satisfaction, and attaching unpleasurable affective significance to percepts which have the opposite effect.

The second organization proposed by Freud has the task of evaluating percepts according to the reality principle. That is to say, there would be greater elaboration of percepts to determine the implications of courses of action with regard to the world of reality. The second organization, upon finding that a course of action proposed by the first system did not meet the demand of reality, would inhibit the first organization from translating its proposal into action.

In recent years there has again been considerable attention focused upon the brain-mind problem, not only among psychiatrists, but among the anatomists and physiologists as well. This seems to have been occasioned by a renewed interest in the earlier discoveries that certain of the more primitive cortical and sub-cortical structures play a significant role in mental processes, particularly affective behavior. With the advent of new techniques, there has been intensive re-investigation of the functions of these areas.

The evident dichotomy between the functions of the newer and older parts of the brain has been extensively restudied (7). The functional differences have been so marked that Mac Lean was moved to describe them as a "schizophysiology" (17). For instance, the phylogenetically older parts of the brain appear to be rather intimately concerned with visceral activity and vital behavior (18). In contrast to responses induced from neocortical areas, which appear to be precise and discrete, the responses elicited from the older struc-

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tures are organized into total perceptual and behavioral patterns (16). The qualities of the responses obtained from studies of the limbic system suggest that this organization serves to mediate affective experience (17, 19).

Associated extralimbic structures of the temporal lobe also appear to play a significant part in affective behavior as demonstrated by conditioning experiments. Injuries to the ventral surface of the temporal lobe, while not interfering with perception, cause a failure to comprehend the significance of relevant perceptual cues (20, 21, 2). The motivation of aversive or aggressive behavior is related to fearful or anxiety-laden affects. That the amygdala is involved in such reactions is indicated by the findings that lesions of the amygdala are followed by loss of appreciation of the significance of aversive stimuli (1, 28), while stimulation of the amygdala will evoke conditioned avoidance (fear) responses (3). The motivation for approach and incorporative behavior, on the other hand, is related to pleasurable experience (29). The septal region and the nearby areas have been implicated in the mediation of such experience (22).

The animal results have a distinct parallel in the human (25, 9). The well known Klüver-Bucy syndrome following bilateral temporal lobectomy in monkeys (13) has been reproduced in man (27). The symptoms include indiscriminate sexual and feeding behavior, increased searching activities, inability to relate to previously significant figures of the environment with a loss of recognition of people, including close relatives (psychic blindness), and a memory defect characterized by an inability to relate current events with past experience (27). Stimulation of the temporal lobe with electrodes or as the result of seizure activity has produced hallucinations, affective reactions, autonomic discharge, and emotional behavior, such as rage and fear reactions (24, 12). Such studies suggest that engrammatic representations of experience are stored in the temporal lobe (23).

These structures are intimately related with diencephalic structures such as the hypothalamus and with the brain stem reticular activating system, which have also been demonstrated to be concerned with emotional and vital behavior (18, 19, 9). Further, a reciprocal relationship of the hippocampus and neocortex has been found to be mediated through the reticular activating system. Thus, stimuli which arouse and desynchronize the neocortex will cause synchronization of the electrical activity of the hippocampus, and vice versa (8, 14).

In short, it would appear that these groups of structures are concerned among other things, with establishing the affective significance of percepts as well as with the selection of appropriate behavior on the basis of prior experience. Thus it would seem that we now do have evidence of a neural basis for some elements of Freud's thesis, and it may be of interest to construct a theoretical neural model which could interpret the physiological findings in terms of the concept of primary and secondary processes. Such an interpretation would hold that the reticular formation, together with diencephalic and rhinencephalic structures and their connections, constitute an affect system, the guiding principle of which is that percepts are associated with each other and with behavior according to their relations with pleasurable or unpleasurable affects.

Thus, we may consider that in primitive vertebrates attempts to relieve the stresses of the internal environment were governed by affective responses mainly to various olfactory messages. The neural patterns arising from olfactory stimuli could be regarded as representatives of the perceived object, the significance of which was determined by the relationship between such a pattern and its potential for relieving the arousal evoked by a simultaneously

perceived visceral pattern, thereby restoring homeostasis.

The visceral message signals a homeostatic shift, thereby warning of an impending stressful state which must be offset. The neural pattern evoked by this message is accompanied by the conscious apperception of an unpleasant affect which increases in intensity as the visceral message continues unabated.

The olfactory percept is a unidimensional cue, a coded signal, representative of a particular quality or characteristic of the perceived object. Such a characteristic is taken to stand for or represent the complete object. If several objects give rise to the same odor, hence the same pattern, they are indistinguishable by this means. If several objects give rise to different odors, the patterns of which bear the same relationship to satisfaction of the drive, they become indistinguishable under the circumstances. The identical olfactory pattern perceived when the animal is hungry, on the other hand, might have a very different "meaning" if the animal has just been fed. The perceptual representative thus comes to stand for (symbolize) the relationship of the object to potential gratification or to potential danger. The object itself has no identity other than in relation to this system, so that the perceptual representative is a symbol for the real object only to the extent of the potential effect of the object upon the internal state.

When such relationships between viscerally evoked and externally evoked patterns have become established by experience, there develop more or less permanent traces or engrams of such patterns within the affect system.

Responses on subsequent re-experiencing of the stressful state are determined by an anticipation of events rather than upon a re-experiencing of the events themselves. The basis for this activity is the relationship between the current perceptual representative of an external object and the engrams corresponding to previous perceptions associated with the relief of the stress. The nature of this relationship is appreciated in consciousness as an affect, pleasant or unpleasant as the case may be.

With the development of neocortical sensory areas, perception can correspond more closely to a representation of the object perceived. We would postulate, however, that characteristics of these perceptual images are nevertheless extracted and relayed to the older apparatus, which are then handled in the same manner as the olfactory patterns. We would expect that such engrams would be stored in the neocortical areas which are closely connected with the more primitive system (23).

The affect system, then, is a predicting device which anticipates the future in terms of the past. The affect is the conscious representation of the relationship of engrams or percept patterns to the current or anticipated internal state. These activities may be illustrated in a highly oversimplified fashion as follows:

Let us suppose that a visceral hunger signal is transmitted to the affect system. This message arouses the activating system, and is represented in the affect system by an engram, the counterpart of which is an unpleasant affect. The activator arouses the system to initiate searching behavior and to scan for the engram patterns which had previously been associated with the satisfaction of the hunger. The arousal of these engrams from within represents the "fantasy" of the satisfying object. If the perceptual representatives of objects perceived during searching behavior do not correspond with the "fantasy" there is continuation of the searching behavior accompanied by an unpleasant feeling of unfamiliarity. If the patterns of objects perceived correspond with the fantasy, approach and incorporative behavior is elicited, accompanied by a pleasant feeling of recognition or familiarity. This step, of course, gratifies the hunger and restores the

homeostasis, thereby deactivating the system—an event which is accompanied by a feeling of pleasure. In this way, fantasy is the tool of foresight, since it serves to predict the object of gratification, thereby facilitating the search for such an object.

In analogous fashion when prior perceptions of an object have been associated with painful experience, its subsequent perception will evoke unpleasure or anxiety, which will eventuate in aggressive or avoidance behavior. The anxiety signal is thus also the instrument of foresight, serving to warn of potential danger.

Despite these advantages for foresight, however, the primitive affect system is subject to deceptions, some of which have clinical counterparts, the neural basis of which may now be traced to this system.

For one thing the engrams do not allow for precise definition of objects, so that discrimination is poor and dependent upon what might be irrelevant cues. There is, furthermore, no way to distinguish between irrelevant and relevant cues if they always occur together. This is in fact what happens during conditioning, where an irrelevant cue becomes substituted for a relevant one. This process is also analogous to the psychological phenomenon of displacement.

Further, even the relevant cues are perceived in a concrete and specific manner. All objects which present the same cue are regarded as identical; no classification or individual differentiation is possible. The affect system is inner, not outer directed; it is entirely autistic and cannot "test reality." An object may be pursued because an irrelevant cue produced a feeling of familiarity (déjà vu) or be avoided because the irrelevant cue searched for was absent (jamais vu). An object which under different circumstances has become associated with both pleasant and unpleasant affects may when perceived provoke uncertainty and indecisive behavior which can endanger the life of the organism, a situation quite analogous to the clinical phenomenon of ambivalence.

Further, the affect system provides for no self-concept (body image) and permits no distinction between internally and externally derived stimuli. There are no "ego boundaries."

It is neocortical development and dominance which provide for the correction of these deficiencies. Not only does the sensory neocortex provide for a more exact definition of percepts, but the dominance of a single sense modality is replaced by simultaneous comparisons of patterns received by various modalities. Onto the "analogue computer" of the affect system is superimposed the "digital computer" of the second or "abstract system" which corresponds with Freud's secondary process. Secondary elaborations and associations of the neocortical sensory patterns permit the identification of individual differences and also allow for classification of individual percepts into groups. The vast network of intercommunication between the receptor and elaborative centers of the abstract system allows for the correlation of information from all modalities and results in a dimensionally oriented concept formation (ego boundaries and reality testing).

The activating system provides for this dominance of the neocortex. Neocortical messages are given priority in consciousness; and while neocortical patterns continue to be scanned by the affect system for their affective significance, the elaborations of these messages are not bound by the visceral needs, but rather may be responsive to other externally perceived stimuli.

Language, the building material of ideation, is now possible. Word symbols, a product of the association of the various neocortical modalities, provide for concepts which can be handled abstractly in contrast with the concrete imagery of the affect system. Communication, previously restricted to the elicitation of an affect in the subject upon the perception of an ob-

ject, now has considerable scope and depth, and represents transmission of ideas rather than percepts.

Perhaps we may best conclude with an illustration of how our neural framework could be applied to the interpretation of specific clinical phenomena. A suitable example might be the phenomenon of hallucinations.

From what we have said with regard to fantasy activity, we would assume that hallucinations could occur with activation from within of an engram eventuating in the conscious perception of an image. Ordinarily in the presence of the neocortex we would not expect such a phenomenon to occur in the waking state. This is because in the presence of neocortical activation from without, the activating system would tend to inhibit the conscious perception of the activities originating in the affect system. Hallucinations with an intact nervous system would therefore be unlikely except under conditions of severe regression in the face of overwhelming anxiety, or in cases of sensory isolation such as in the phenomena described by Hebb (11) and Lilly (15), or during sleep when sensory input to the neocortex is greatly curtailed (dream activity).

Toxic substances could produce hallucinations either by activating the exteroceptive engrams, or by interfering with the functioning of the activating system. In the first case, neocortical correlations would still be possible and the hallucination could be identified as unreal; in the latter case, reality testing could fail and the hallucination be accepted as reality. In schizophrenia we have postulated an overloading or jamming of the circuits of the activator system with a resulting failure of reality testing, disorganization of abstract thinking, and a regression to the patterns of behavior characteristic of the more primitive affect system (26). It has been suggested that the psychic symptoms in temporal lobe epilepsy are due to an activation by the seizure discharges of the engram patterns associated with the affect system which are housed in the temporal lobe (23).

In summary, we have proposed a neural model for certain mental processes designed to interpret some of our recent knowledge of the brain in terms of Freud's early concept of primary and secondary processes. While such models are, by their nature, extremely unprecise, it is hoped that they may serve as frameworks for the objective study of psychological theory as well as for the interpretation of physiological findings. Above all, it is hoped that communication between experimental and clinical workers may be facilitated.

REFERENCES

1. Brady, J. V., Schreiner, L., Geller, I. and Kling, A. Subcortical mechanisms in emotional behavior: The effect of rhinencephalic injury upon the acquisition and retention of a conditioned avoidance response in cats. J. Comp. & Physiol. Psychol., **47**: 179–186, 1954.
2. Chow, K. L. Effects of temporal neocortical ablations on visual discrimination learning sets in monkeys. J. Comp. & Physiol. Psychol., **47**: 194–198, 1954.
3. Delgado, J. M. R., Rosvold, H. E. and Looney, E. Evoking conditioned fear by electrical stimulation of subcortical structures in the monkey brain. J. Comp. & Physiol. Psychol., **49**: 373–380, 1956.
4. Freud, S. The unconscious, In *Collected Papers* Vol. 4, pp. 98–136. Hogarth Press and the Institute for Psychoanalysis, London, 1949.
5. Freud, S. Project for a scientific psychology, In *The Origins of Psychoanalysis*, pp. 347–445. Basic Books, Inc., New York, 1954.
6. Freud, S. *The Interpretation of Dreams*. Chap. 7, Basic Books, Inc., New York, 1954.
7. Fulton, J. F. Recent advances in neurophysiology. J. Neurosurg. **11**: 1–6, 1954.
8. Green, J. D. and Arduini, A. A. Hippocampal electrical activity in arousal. J. Neurophysiol., **17**: 533–557, 1954.
9. Heath, R. G. Correlations between levels of psychological awareness and physiological activity in the central nervous system. Psychosom. Med., **17**: 383–395, 1955.
10. Hebb, D. O. The problem of consciousness and introspection, In *Brain Mechanisms and Consciousness*. Council for International Organizations of Medical Sciences. Blackwell Scientific Publications, Oxford, 1954.
11. Hebb, D. O. The mammal and his environment. Am. J. Psychiat., **111**: 826–831, 1955.

12. KARAGULLA, S. AND ROBERTSON, E. E. Psychic phenomena in temporal lobe epilepsy and the psychoses. Brit. M. J., **1**: 748–752, 1955.
13. KLÜVER, H. AND BUCY, P. C. Preliminary analysis of functions of the temporal lobes in monkeys. Arch. Neurol. & Psychiat., **42**: 979–1000, 1939.
14. LIBERSON, W. T. AND AKERT, K. Hippocampal seizure states in guinea pig. Electroencephalog. & Clin. Neurophysiol., **7**: 211–222, 1955.
15. LILLY, J. C. Mental effects of reduction of ordinary levels of physical stimuli on intact healthy persons. Psychiat. Res. Rep., **5**: 1–28, 1956.
16. LIVINGSTON, R. B. AND WORDEN, F. G. Some neurophysiological contributions to internal medicine. Stanford M. Bull., **13**: 194–203, 1955.
17. MACLEAN, P. D. The limbic system ("Visceral Brain") and emotional behavior. A. M. A. Arch. Neurol. & Psychiat. **73**: 130–134, 1955.
18. MACLEAN, P. D. The limbic system and its hippocampal formation. J. Neurosurg., **11**: 29–44, 1954.
19. MACLEAN, P. D. The limbic system ("Visceral Brain") in relation to central gray and reticulum of the brainstem. Psychosom. Med., **17**: 355–366, 1955.
20. MISHKIN, M. Visual discrimination performance following partial ablations of the temporal lobe. II. Ventral surface vs. hippocampus. J. Comp. & Physiol. Psychol., **47**: 187–193, 1954.
21. MISHKIN, M. AND PRIBRAM, K. H. Visual discrimination performance following partial ablations of the temporal lobe. I. Ventral vs. lateral. J. Comp. & Physiol. Psychol., **47**: 14–20, 1954.
22. OLDS, J. AND MILNER, P. Positive reinforcement produced by electrical stimulation of septal area and other regions of the rat brain. J. Comp. & Physiol. Psychol., **47**: 419–427, 1954.
23. PENFIELD, W. The twenty-ninth Maudsley Lecture. The role of the temporal cortex in certain psychical phenomena. J. Ment. Sc., **101**: 451–465, 1955.
24. PENFIELD, W. AND JASPER, H. H. *Epilepsy and the Functional Anatomy of the Human Brain*. Little, Brown and Co., Boston, 1954.
25. POOL, J. L. This visceral brain of man. J. Neurosurg., **11**: 45–63, 1954.
26. ROSENZWEIG, N. A mechanism in schizophrenia: A theoretical formulation. A. M. A. Arch. Neurol. & Psychiat., **74**: 544–555, 1955.
27. TERZIAN, H. AND DALLE ORE, G. Syndrome of Klüver and Bucy reproduced in man by bilateral removal of the temporal lobes. Neurology, **5**: 373–380, 1955.
28. WEISKRANTZ, L. Behavioral changes associated with ablation of the amygdaloid complex in monkeys. J. Comp. & Physiol. Psychol., **49**: 381–391, 1956.
29. YOUNG, P. AND SHUFORD, E. H. JR. Intensity, duration, and repetition of hedonic processes as related to acquisition of motives. J. Comp. & Physiol. Psychol., **47**: 298–305, 1954.

RECALL OF SOME PHENOMENA OF SLEEP

A Comparative Study of Dreams, Somnambulism, Orgasm and Enuresis in a Control and Neurotic Population

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The frequency with which the various phenomena of sleep occur in a non-psychiatric or control population as compared with a neurotic population poses a singularly interesting problem. This information might provide a base-line for the further evaluation of symptoms in the individual patient which would be significant for a diagnostic and prognostic appraisal. This paper then is concerned with studying the recall of sleep phenomena in both the neurotic and control clinic groups.

SUBJECTS AND PROCEDURES

The subjects for this investigation were 82 control and 87 neurotic white males and females in approximately equal distribution as to sex and age, which distribution was accomplished by matching. They ranged in age from 15 to 69 years and were patients of the Washington University Clinics. Thus, a similarity of socio-economic background was assured. There were 43 male controls with a mean age of 42.5 years and 39 female controls with a mean age of 38.8 years. These were matched with 28 male neurotic patients with a mean age of 36.1 years and 59 female neurotic patients with a mean age of 39.2 years. The control patients were being seen for distinctly non-psychiatric medical problems and as far as could be ascertained had never been treated for a psychiatric condition. The neurotic patients were from the Washington University Psychiatric Clinic and had been diagnosed as suffering from a neurotic illness. All patients were individually interviewed by one of the authors during one of their routine visits to the clinic. Every effort was made to place the subject at ease and to make sure that the questions were understood. A structured interview was used and the questions were presented to the subjects with an effort to maintain uniformity from case to case. Occasionally for any one particular question, an answer adequate for rating was not received by the interviewer, thus accounting for the slight differences seen in the number of subjects in the various tables.

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RESULTS

Results are presented in the form of tables which are accompanied by comparisons with previously reported studies, in order to put the present findings in the perspective of previous investigations.

DREAMING: An effort was made to determine whether the subjects dreamt and whether this was a rare, occasional or frequent occurrence. The results are reported in Table 1.

De Martino (3) and Husband (6) both found no sex differences as to the presence or absence of dreaming among college students.

DREAMING IN COLOR (Table 2): De Martino and Husband, investigating college students reported 17 per cent and 40 per cent of color dreamers respectively. Both of these investigators found the phenomonon three times more prevalent among the females in their groups. In our study the tendency for more neurotics to report dreams in color is mainly due to the female neurotic.

NIGHTMARES AND PLEASURABLE DREAMS (Table 3): De Martino similarly reported no sex differences in the number of nightmare dreams among his college students. The re-

TABLE 1
Reported Incidence of Dreams

	% who Dream	Dream Frequently		Dream Occasionally		Dream Rarely	
		N	%	N	%	N	%
Control male, 42Ss	98	7	17	14	33	21	50
Control female, 37Ss	95	9	24	16	43	12	32
Total control, 79Ss	95	16	20	30	38	33	42
Neurotic male, 26Ss	93	9	35	9	35	8	30
Neurotic female, 57Ss	97	22	39	19	33	16	28
Total neurotic, 83Ss	95	31	37	28	34	24	29

TABLE 2
Reported Incidence of Dreams in Color

	Number Reporting Color Dreams	% Reporting Color Dreams
Control male, 42Ss	4	10
Control female, 37Ss	3	8
Total control, 79Ss	7	9
Neurotic male, 26Ss	3	12
Neurotic female, 57Ss	12	21
Total neurotic, 83Ss	15	16

port of this phenomenon is seen to increase among neurotics as compared to controls in our study.

SOMNAMBULISM AND ENURESIS: Somnambulism was considered present if the subject ever walked in his sleep and enuresis was defined as having wet the bed in sleep after the age of five. Table 4 shows how these phenomena were reported.

Both Pai (9) and Sandler (10) consider somnambulism a neurotic reaction. Pai found it present at the time of his investigation in 117 cases among 1853 neurotic males of which 90 were from psychogenic causes (27 were either post-epileptic, post-infective or hystero-malingering). Our material represents historical data, whereas Pai's six per cent represented active cases of somnambluism among male neurotics.

Enuresis in normal individuals after the age of five was more common in males than in females with 37 per cent and 21 per cent (Table 4). The greater percentage of male enuretics is a well known finding (1, 5). Percentages in the general population, however, vary greatly in different studies: Thorne (12) among 1000 consecutive selectees noted 16.1 per cent at age five, 12.9 per cent at age seven, 8.5 per cent at age ten, and 2.5 per cent at age 17. Blomfield and Douglas (1) found 12.2 per cent at age four and 7.3 per cent at age 7¾. Hallgren (5) at age five found a total of 8.9 per cent bed-wetters. Sheldon (11) found 5 per cent of 5000 between five and ten years of age while Gordon (4) had 7 per cent out of 200 between five and 14 years of age. Our high figures result from the inclusion of the oc-

TABLE 3
Quality of Reported Dreams

	Ever have Nightmares		Dreams were Pleasurable	
	N	%	N	%
Control males, 42Ss	20	48	22	52
Control females, 37Ss	15	41	28	76
Total control, 79Ss	35	44	50	63
Neurotic males, 26Ss	15	58	15	58
Neurotic females, 57Ss	36	63	30	53
Total neurotic, 83Ss	51	61	45	54

TABLE 4
Reported Enuresis and Somnambulism

	Enuresis		Somnambulism	
	N	%	N	%
Control male, 43Ss	16	37	7	16
Control female, 39Ss	8	21	4	10
Total control, 82Ss	24	29	11	13
Neurotic male, 28Ss	11	39	4	14
Neurotic female, 59Ss	20	34	6	10
Total neurotic, 87Ss	31	36	10	11

casional bed-wetter in contrast to other studies which define the enuretic by the criteria of consistency and persistency. Hallgren also noted enuresis to be more frequent in lower social strata and Blomfield and Douglas found the lowest incidence among prosperous groups. Since we were sampling a clinic population this may have caused our percentages to increase.

REPORT OF ORGASMS DURING SLEEP AND DREAMS: A positive response was counted when a subject reported experiencing "wet dreams", climaxes or orgasms in his sleep or dreams. These data are presented in Table 5.

TABLE 5
Reported Incidence of Nocturnal Orgasms

	Reported Having Had Nocturnal Orgasms	
	N	%
Control male, 43Ss	22	51
Control female, 39Ss	3	8
Neurotic male, 28Ss	17	61
Neurotic female, 59Ss	28	47

Kinsey (8) reported 83 per cent of his total male sample having had nocturnal orgasms. In the female, Kinsey (7) reported 1761 out of 7789 women or 22 per cent of a mixed racial group to have had nocturnal orgasms at one time or another. Kinsey found nocturnal orgasms among men more frequent at higher educational levels, and reported an incidence of 99 per cent among those who go to college. Weissenberg (13) found 12 per cent of 324 female Russian students had experienced orgasms during dreams.

With respect to reported nocturnal orgasm it is of interest to note that, comparing married control males with single control males, the figures were 19 out of 28 subjects or 68 per cent and 3 out of 13 or 23 per cent, respectively. Among neurotic males the married men showed 12 out of 16 having had nocturnal orgasms as opposed to 4 out of 11 of single men. Kinsey too found a higher incidence of nocturnal orgasms among married men.

In the neurotic group of females reported in this paper startling increases are noted. This is seen in the female neurotics who report an incidence of 47 per cent as compared to 8 per cent in the control female. No comparison as regards marriage was possible in this area because of the small number of single females in both groups. In the male the comparable rise is considerably smaller, *i.e.*, from 51 per cent to 61 per cent from control to neurotic. This increase in reported nocturnal orgasms among neurotic females is the most striking finding in this present study.

DISCUSSION

The question arises as to what significance might be ascribed to the above data. Certainly there are general aspects which are worthy of note, one of which is the variability of incidence of certain reported symptoms among different socio-economic groups. Such a finding as the relatively low frequency of nocturnal orgasm recalled by the males of a clinic group (51 per cent) in comparison to the figures of Kinsey of men who have gone to college (99 per cent) is a matter of some importance. It points to the necessity for a control group to clearly hold constant extraneous factors which may incidentally have some relevance to the subject on which the research is being done. Such a problem is clearly handled by having control and experimental groups which belong to the same segment of the population; and for certain types of clinical research, the clinics of a general hospital and medical center serve quite well. The similarity of the number of dreams in color reported by the female neurotics (21 per cent) to the number reported by female college students in two different studies (17 per cent; 40 per cent), as well as the increase of male nocturnal orgasms with neurosis

provides the basis for an interesting speculation in the same realm; namely, how much of the neurosis is really the same as the increased sophistication which is seen in the higher socio-economic groups. The data suggests that there is an area of linkage between socio-economic status, sophistication and presence of neurosis.

Among the more interesting aspects of the data is the equal prevalence of histories of somnambulism and enuresis in both control and neurotic populations. There are, of course, no data on how many enuretics might be considered to be neurotic later in life. It might be expected to be more often noted in the histories of the neurotics than of controls or non-psychiatric populations. This was in fact the case, although the reported difference was small. This small difference hardly justifies thinking of the symptoms of enuresis as foreboding illness in terms of future psychiatric difficulties. It is noteworthy that Brockway, *et al* (2) found that three control groups which were compared with psychiatric patients had equivalent developmental habits such as nail biting and enuresis. As a result they raised the question as to whether these forms of behavior can be used as prognostic of adult maladjustment.

Perhaps the most striking finding in the present study, however, is that of the high incidence of nocturnal orgasms reported by female neurotics (47 per cent) as opposed to the incidence reported by female controls (8 per cent). Whether this finding is always associated with dreams and what it signifies is, of course, quite problematic. Classically, neurosis is considered to be associated with inadequate sexuality but whether this is correlated positively with the presence of the nocturnal orgasms in females is a question not yet possible to answer. There is some possibility that this might be so and this is suggestive of Freud's original theory of anxiety in which he postulated that pent up sexual energy promoted anxiety. If neurotic women can be considered more anxious it would then follow that there would be a positive correlation of neurosis with sexual difficulties with nocturnal orgasms. This area, however, is one which needs more exploration.

At this point it is difficult to resist a comparison with Kinsey's figures for nocturnal orgasm in the female. Kinsey's incidence of 22 per cent in a mixed racial group is midway between the neurotic (47 per cent) and control (8 per cent) frequencies reported here. Whether this means that a high proportion of Kinsey's interviewees were neurotic or that once more that they contained a larger percentage of higher socio-economic group people who are similar to our neurotic patients because of the possible relationship of sophistication and psychoneurosis is impossible to know. A further explanation for the discrepancy might be that Kinsey's subjects, were not medically ill whereas our controls were patients in medical and surgical clinics.

In considering the possible comparative reluctances or propensities of subjects to "admit" some of the symptoms such as enuresis and nocturnal orgasms it is noteworthy that there was no consistent pattern that might indicate that this happened to be a factor. If the neurotics of the study may have weighed, say, nocturnal orgasms in such a way that they may have had a propensity to "admit", then it becomes conspicuous that enuresis or somnambulism was not weighed in the same way. In addition, if psychiatric patients feel they must reveal sexual data it is striking that this apparently occurred only among the females reporting.

SUMMARY

A comparative study of the recall of dreams, somnambulism, orgasms and enuresis was carried out in a clinic, using 82 white non-psychiatric controls and 87 white neurotic patients, each of which was examined by means of a structured interview.

Almost all subjects reported dreaming but

neurotic subjects tended to recall dreaming more frequently than controls and neurotic female subjects tended to report dreaming in color more frequently. Nightmares were somewhat more frequently reported in neurotic subjects. There were no striking differences between groups in the area of dreaming.

Neurotic females tended to report a history of enuresis more frequently than control females but in general the differences between controls and neurotics on the subjects of enuresis and somnambulism were not striking.

Neurotic males reported having had nocturnal orgasms somewhat more frequently than control males; and both married controls and married neurotic males showed a higher incidence of having had this experience than their single counterparts.

Neurotic females showed a 47 per cent incidence of recalling nocturnal orgasms as opposed to 8 per cent of control females.

REFERENCES

1. Blomfield, J. M. and Douglas, J. W. Bedwetting prevalence among children aged 4–7. Lancet, **270**: 850–852, 1956.
2. Brockway, A. L., Gleser, G., Winokur, G. and Ulett, G. The use of control population in neuropsychiatric research (Psychiatric, psychologic, and E. E. G. evaluation of a heterogenous sample). Am. J. Psychiat., **3**: 248–262, 1954.
3. De Martino, M. F. Sex differences in the dreams of southern college students. J. Clin. Psychol., **9**: 199–201, 1953.
4. Gordon, I. Allergy, enuresis and stammering. Brit. M. J., **1**: 357–358, 1942.
5. Hallgren, B. Enuresis. I. A study with reference to the morbidity risk and symptomatology. Acta Psychiat. et Neurol. Scandinav., **31**: 379–403, 1956.
6. Husband, R. Sex differences in dream contents. J. Abnorm. & Social Psychol., **30**: 513–521, 1935.
7. Kinsey, A. C. and others. *Sexual behavior in the human female*. W. B. Saunders Co., Philadelphia, 1953.
8. Kinsey, A. C., Pomeroy, W. B. and Martin, C. E. *Sexual behavior in the human male*. W. B. Saunders Co., Philadelphia, 1948.
9. Pai, M. N. Sleep walking and sleep activities. J. Ment. Sc., **92**: 756–765, 1946.
10. Sandler, S. A. Somnambulism in the armed forces. Ment. Hyg., **29**: 236–247, 1945.
11. Sheldon, W. Discussion on enuresis. Proc. Roy. Soc. Med., **37**: 348–349, 1944.
12. Thorne, F. C. The incidence of nocturnal enuresis after age 5. Am. J. Psychiat., **100**: 686–689, 1944.
13. Weissenberg, S. Das Geschlechtsleben der Russichen Studentinen (Schbankov Study, 1908. Reported 1922) Ztschr. Sexual Wissensch., **11**: 7–14, 1922.

PSYCHODYNAMIC RELATIONSHIPS BETWEEN THE DEGREE OF ANXIETY AND OTHER CLINICAL SYMPTOMS[1]

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For a period of six years we have been studying anxiety under various experimental situations and also relationships between the quantitative degree of anxiety and the production and amelioration of other clinical psychiatric symptoms. These studies are a part of a broader investigation of the relationship between psychophysiological mechanisms and psychodynamics. In this particular phase of our work we were attempting to learn whether the pattern of symptom formation was similar under different types and degrees of stress.

METHODOLOGY

Several lines of research were used, material being gathered through the following techniques:

1. Intensive reconstructive psychoanalyses (12 patients)
2. Psychoanalytically oriented psychotherapy in combination with ataraxic drugs (175 patients)
3. Use of hallucinogenic drugs (mescaline and lysergic acid) (25 patients)
4. Use of intravenous chlorpromazine and promazine
   A. For the treatment of severely ill schizophrenic patients (35 patients)
   B. To block the effects of Mescaline or Lysergic Acid (25 patients)
5. Psychosurgical procedures performed on the conscious schizophrenic patient under local anesthesia
   A. During craniotomy proper (43 patients)
   B. During and immediately following prefrontal lobotomy (34 patients)

Most of the patients included under Group 5 were also exposed to techniques 3 and 4. A number of patients included under technique 2, initially, were treated with intravenous tranquillizing drugs (Group 4).

The diagnostic spectrum of psychiatric patients used in this study was very broad. All the patients treated by intensive reconstructive psychoanalyses could best be characterized as having psychoneuroses in combination with social and sexual maladaptation. Those treated with the combined brief psychoanalytically oriented psychotherapy-ataraxic drug technique included schizotypes in various degrees of compensation, patients with involutional depressions and patients with psychoneuroses. Only severely ill schizophrenic patients were exposed to techniques 3, 4 and 5.

DEFINITION OF ANXIETY AND TECHNIQUES OF EVALUATING DEGREE OF ANXIETY

In all phases of our studies, anxiety was defined for our purposes in the broadest possible aspect, namely, that it was a psychophysiological phenomenon which we considered synonymous with fear, in spite of whether the fear was generated by unconscious conflict or actual environmental threats whether these threats were biosocial, biochemical or exposure to intracranial operations under local anesthesia.

The definition was purposely very broad in its scope because as yet there are no clear-cut clinical biochemical or psychophysiological perameters available for the study of anxiety. Also in the acute experiment it is not feasible to attempt to differentiate between the fear of the experimental situation and the emergence of unconscious terrors, especially on a quantitative basis

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We found it helpful, indeed necessary, to divide and to analyze anxiety in terms of four components:

1. Motor component
2. Affectual component
3. Verbal component
4. Autonomic component

An attempt was made to quantitate the degree of intensity of each component as follows:

Motor Component

Palpation, passive and active movement used as a means of evaluation

Key:

(a) Calm—no restlessness, no tremor, no increase in muscle tonus

(b) Slight—slight increase in muscle tonus, slight restlessness, slight tremor

(c) Moderate—moderate increase in muscle tonus. Marked restlessness. Passive movement difficult

(d) Severe—thrashing about wildly, incessant movement

Affectual Component

Facial expressions; tone, quality and volume of voice used as means of evaluation

Key:

(a) Calm

(b) Slight

(c) Moderate—(patient obviously disturbed)

(d) Severe (patient in panic)

Autonomic Component

We could not accurately quantitate the degree of autonomic change. We measure vital signs and in some did psychogalvanometric recordings. Electroencephalographic studies were made in some of the psychosurgical cases and on some of the patients receiving hallucinogenic agents.

Verbal Component

Evaluated according to pressure of speech

(a) Normal conversational pattern

(b) Slight pressure of speech

(c) Moderately severe pressure of speech

(d) Extreme logorrhea

All of these components were then weighed together to give the final evaluation of the degree of anxiety present.

RELATIONSHIP BETWEEN MOUNTING ANXIETY AND SYMPTOM FORMATION

The results of the various research techniques mentioned above all appeared to indicate that there was a direct relationship between the quantitative degree of anxiety and the formation of other clinical psychiatric symptoms and signs (2, 3). The symptoms and signs such as phobias, obsessive-compulsive states, hypochondriasis, psychosomatic complaints, paranoid delusions, hallucinations, etc., appeared to be secondary defense mechanisms against the pressure of the mounting anxiety.

Twenty-one of the 25 patients, who received either mescaline intravenously or lysergic acid orally, demonstrated definite evidences of mounting anxiety before there were any other symptomatic expressions (Table 1). In seventeen of the 21 patients, motor restlessness and increased muscle tonus was the heralding indication of mounting anxiety. The various psychiatric symptoms began to manifest themselves usually only after there were definite alterations in the affectual component. Autonomic changes, where our measurements indicated a significant alteration, usually occurred simultaneously with a definite in-

TABLE 1

Mounting Anxiety and Symptom Formation

Pattern of Investigation	Number of Patients	Patients Manifesting Increased Anxiety Prior to Other Symptoms	
		Number	Percentage
Mescaline or Lysergic acid	25	21	84
Craniotomy under local anesthesia	43	40	93
Combined psychotherapy-drugs	112	91	81

crease in the affectual component. There were 3 patients in catatonic stuperous states who demonstrated autonomic changes before motor changes occurred.

A similar general pattern existed in the studies made on patients exposed to the stress of a large craniotomy performed under local anesthesia. Forty of the 43 patients studied during craniotomy manifested a definite increase in various components of anxiety before there were manifestations of other psychiatric symptoms. In this series of observations, as in the studies of the hallucinogenic agents, the motor component of anxiety was altered first in the vast majority of cases. Thirty-five of the 40 patients (88 per cent) who showed a definite increase in anxiety, prior to the appearance of secondary symptoms, demonstrated restlessness or increased resistance to passive movement before affectual or autonomic changes were elicited. In 31 of these patients the secondary symptoms appeared only after the affectual component was definitely increased.

In 112 of the patients, who were eventually treated by the combined psychotherapy-ataraxic drug technique, we were able to obtain very detailed histories, which, when analyzed from the standpoint of the relationship of anxiety and symptom-formation, convincingly indicated, in 91 cases (81 per cent), a definite mounting anxiety level prior to the onset of other clinical manifestations.

Another striking observation was that in patients exposed to, what may be called "maximum stress", (*i.e.* mescaline or lysergic acid, craniotomy under local anesthesia and patients seen in acute panic reaction from overwhelming social pressures) showed, in almost all instances, a diffuse pan-anxiety state by the time the affectual component became very obvious. All patients, at this point were reacting not only to the stress of the immediate situation, but to the emergence of unconscious conflicts which were released under the pressure of the mounting anxiety. The combination of the immediate and more remote traumas caused the crescendo into the pan-anxiety state. It was in this psychophysiological setting that other clinical symptoms made their debuts.

From these studies, the psychophysiological relationship between the pressure of anxiety and appearance of other psychiatric symptoms and signs, which we consider as being secondary defense mechanisms, seemed to be as follows: Initially a state of mounting anxiety was produced by an environmental stress (*i.e.* an internal or external biophysical stress or an external biosocial problem) with which the patient could not cope. This in turn stimulated, or perhaps permitted the emergence, of unconscious conflicts, originating from past traumas, this combination of stresses precipitating a diffuse pan-anxiety state. It was then that psychiatric symptoms, such as phobias, hypochondriasis, obsessive thinking, etc., appeared individually or in a succession, the exact symptoms and pattern of appearance being unique to each patient. As the anxiety mounted, more and more of these secondary defense mechanisms were brought into play, in an attempt to diminish, or perhaps serving as a buffer against the mounting anxiety. This pattern brought to our minds the mental image of an engineer attempting to stop the forward rush of a runaway locomotive by applying ever increasing pressure on the brakes. Eventually if these "mental breaking mechanisms" did not quantitatively decrease the level of anxiety, the patient's ego defenses were overwhelmed. In patients with a schizoid matrix, this overwhelming of the ego defenses, lead to impairment of reality contact with the patient being dominated by feelings of dissociation or dissolution or other bizarre aberrations. In a number of patients who had been studied previously with the hallucinogenic agents or who otherwise had been observed during one or more panic states, we were able to abort the

mounting anxiety by the use of intravenous chlorpromazine or promazine, thereby preventing the emergence of the symptom pattern that otherwise would have appeared.

Another phase of our studies concerned itself with the problem of whether individual patients have essentially the same sequence of symptom appearance in response to repeated bouts of marked anxiety developing secondary to severe stress (Table 2). In a study of 88 patients who were followed for more than one year, and who, during this period, had two or more periods where they manifested acute severe psychiatric flare-ups, 74 (84 per cent) had essentially the same sequence of symptom-formation during the repeated periods of stress. Thirty-eight of the 43 schizophrenic patients, who were studied while craniotomies were being performed under local anesthesia, had two or more episodes during which time there was a marked increase in the level of anxiety in response to the stress of the operations. Thirty-three (87 per cent) of these 38 patients showed essentially the same sequence of symptom appearance with each bout of anxiety. The number of symptoms manifested roughly seemed to depend upon the quantitative degree of anxiety on each occasion.

TABLE 2

Similarity of Symptom Appearance in Response to Repeated Bouts of Anxiety

Pattern of Investigation	Number of Patients	Patients Demonstrating Similar Response to Repeated Stress	
		Number	Percentage
Craniotomy under Local Anesthesia	38	33	87
Combined Psychotherapy-Drugs	88	74	84

RELATIONSHIP BETWEEN DECOMPRESSION OF ANXIETY AND SYMPTOM AMELIORATION

We observed that the degree of anxiety must be first decreased *before* a symptom or succession of symptoms disappears. It was noted, among patients successfully treated by means of the combined tranquillizer-psychoanalytically oriented psychotherapy technique, that although symptoms might remain for a period of days, after the level of anxiety was first decreased, there was less emotional impact associated with these symptoms. A given symptom or group of symptoms did not seem to completely disappear until the degree of anxiety decreased below a certain threshold which was unique for the individual patient. This transition period, in which a symptom was relatively denuded of its original emotional impact prior to the complete clearing of the symptom, was usually very striking. It is not usually so dramatically seen in patients treated with psychotherapy alone, because the process of improvement is much more gradual in this instance.

Our observations during the past few years have pointed up to us that the last symptom to appear, during the period when tension is mounting, is usually to first symptom to disappear when the level of anxiety is reduced (4, 5). Of the 175 patients treated with the combined psychotherapy-drug therapy technique, we found that the general pattern of disappearance of symptoms was the reverse of the sequence of symptom appearance in 144 patients (82 per cent). Similarly, in the study of 88 patients, followed for more than 1 year and who, during this time had 2 or more episodes in which they manifested severe psychiatric flare-ups, 66 (75 per cent) had essentially the same pattern of symptom amelioration following the repeated periods of anxiety decompression.

Of the 25 patients given intravenous chlorpromazine or promazine to block the effects of mescaline or lysergic acid 17 (68 per cent) showed a general reversal of the pattern of symptom appearance during the phase of anxiety amelioration.

TABLE 3

Decrease in Components of Anxiety in Relation to Fractional Pre-Frontal Lobotomy

	Component of Anxiety	Number of Cases
Quadrant No. 1	Motor	16
	Affectual	2
	Verbal	0
Quadrant No. 2	Motor	11
	Affectual	11
	Verbal	1
Quadrant No. 3	Motor	0
	Affectual	11
	Verbal	8
Quadrant No. 4	Motor	2
	Affectual	1
	Verbal	11

We also found that the various components of anxiety were not ameliorated simultaneously. While this often was noted following the intravenous administration of chlorpromazine or promazine to patients under severe stress secondary to mescaline or lysergic acid, it was demonstrated most dramatically during or immediately following the 34 pre-frontal lobotomies performed under local anesthesia (2, 6). For descriptive reasons, we had divided each frontal lobe into two halves, medial and lateral, making four quadrants in all that had to be cut. Twenty-nine of the 34 patients demonstrated a definite decrease in anxiety during or just minutes following the lobotomy. All 29 showed a definite lessening of the motor component, while in 25 the affectual component was ameliorated and in 20 the verbal component was changed. Table 3 shows that a greater amount of frontal lobe white matter had to be sectioned to cause a change in affect than was required to produce a change in muscle tension or motor activity. Similarly it appeared that an even larger leukotomy was necessary to produce a change in verbal content. We also found that the various clinical psychiatric symptoms (*i.e.* phobias, hypochondriacal reactions, obsessive thinking, etc.) did not begin to fade until the affectual component of anxiety was first significantly ameliorated.

Six patients had leukotomies performed while they were actively hallucinating. In five the hallucinations either improved or disappeared. It was clearly discernible that the improvements occurred only after there was first a marked decrease in anxiety. For example, three patients were hallucinating in all spheres and demonstrated very primitive structuring of their aberrations. When the motor and affectual components of anxiety had been greatly reduced, the tactile and olfactory aspects disappeared and the manifest content of the auditory and visual hallucinations was better organized. In two others, the hallucinations disappeared entirely even before the last quadrant had been cut.

Dreams behave in a similar manner. The combined psychotherapy-drug therapy technique offers an excellent opportunity to observe just what happens psychodynamically to dreams when anxiety is rapidly decompressed. The emotional impact of dreams was affected first. This was most clearly seen with nightmares and rage dreams. In the early phase of phenothiazine therapy, the patients continued to have the same dreams that were accompanied by marked terror or rage prior to the onset of treatment, but now the emotional impact was blunted. The manifest content was the same, but the dreams were denuded of rage or terror. After a few more days the manifest content of the dreams changed too. It appeared that it was not until the level of anxiety was decreased below a certain threshold, which was unique for a given patient, that the manifest content of the dream was changed. The same phenomenon can be seen during the course of a successful psychoanalytic therapy in the absence of drug therapy, in that patients who have shown significant improvement may often relate dreams with similar content to some that had nightmare quality early in

treatment but which in the advanced stage of treatment had lost their terror.

DISCUSSIONS AND CONCLUSIONS

In these studies patients were exposed to marked stress of one or more types; namely, biosocial, biochemical, neurophysiological and the stress of an intracranial operation performed under local anesthesia. In spite of the technique used to produce the trauma, the response to the threatening situation followed patterns that were similar in many ways. We believe that our results indicate an intimate and direct relationship between the quantitative degree of anxiety and the emergence of other clinical psychiatric symptoms and signs. The greater the stress, the greater the degree of anxiety; the greater the degree of anxiety the more symptoms and signs that are called into play.

We believe that our studies also show that the quantitative degree of anxiety must first be decompressed before there can be any amelioration of the various clinical symptoms. The different phases, through which the patients passed before there was psychic integration on a high level appeared to be the same whatever the therapeutic technique. Only the rate or reintegration and improvement appeared to vary with the different therapies. It was also striking to us that as the degree of anxiety repeatedly mounted, in response to repeated dangers, whether real or apparent, the pattern of symptom appearance tended to be more or less stereotyped for a given patient. Similarly, the repeated patterns of clinical improvement, in the individual patient, seemed to follow a trend.

The question then arises as to just how the various quantitative degrees and components of anxiety are related to other clinical psychiatric symptoms and signs. We believe that an explanation is available, if we consider the degree and components of anxiety and the other symptoms as the expressions of a hierarchical order of higher central nervous system functioning. We postulate that the manifestations of anxiety are expressions of a state of disequilibrium within the more primitive phylogenetically older physiological mechanisms of the brain. The various components of anxiety that present themselves clinically as the stress is increased might be considered as manifestations of disequilibrium as phylogenetically newer and higher subcortical mechanisms are called into play in an attempt to govern the failing more primitive neural defense mechanisms. It seems that it is not until these subcortical processes of neural integration are overwhelmed that the higher cortical regulatory mechanisms are challenged. Following the same frame of reference, the different psychiatric symptoms such as phobias, obsessive-compulsive states, and the like, might then be considered as reflections of disfunction at the highest level of neural activity.

The hierarchical concept of neural organization is certainly not new. Hughlings Jackson first proposed it is 1898 (1) in his attempt to explain the mechanisms of epileptic seizures. A large body of neurological and neurophysiological research, during the past half century, has given substance to the concept of a hierarchically ordered system of neural integration and to the dynamic interrelationship between all of the levels within the system.

The various psychotherapeutic techniques have contributed greatly to our understanding of normal and abnormal expressions of the highest level of neural activity. If one can conceive of dreams as being a manifestation of subcortical activity temporarily released from cortical control, then current psychiatry has also contributed to our knowledge of this neural phenomenon. However, a very broad hiatus still exists in our understanding of the psychiatric manifestations of the phylogenetically older neural mechanisms. We believe that further multi-disciplinary research directed toward such an understanding would

greatly enhance our appreciation of the dynamics of psychiatric illness.

REFERENCES

1. Jackson, J. H. Relations of different divisions of the central nervous system to one another and to parts of the body. Lancet, **1**: 79–87, 1898.
2. Lesse, S. Experimental investigations on psychosurgical patients. In Hoch, P. H. and Zubin, J., eds. *Experimental Psychopathology*, pp. 246–254. Grune & Stratton, New York, 1957.
3. Lesse, S. Observations of schizophrenic patients during psychosurgery performed under local anesthesia. Dis. Nerv. System, **17**: 57–59, 1956.
4. Lesse, S. Psychotherapy and the ataraxics. Am. J. Psychotherapy, **10**: 448–459, 1956.
5. Lesse, S. Combined use of psychotherapy with ataraxic drugs. Dis. Nerv. System, **18**: 334–338, 1957.
6. Lesse, S., Hoch, P. H., Ransohoff, J., Sloan, N. and Glussman, M. Observations of temporal lobe stimulation and psychosurgery under local anesthesia. Tr. Am. Neur. A., **80**: 48–50, 1955.

CHANGES IN THE SYMBOLIC PROCESS DURING A PSYCHOANALYTIC TREATMENT

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The mechanism of symbolization has never been clearly defined. We hear of it in the "psychoanalytic sense" os opposed to the general meaning. It is questionable that such a dichotomy should be made.

Symbolization is an integral part of the learning process and of general communication. Through mathematics and speech, it has brought man to high levels of individuation and rationality. The symbolic process through its subsidiary, abstraction, permitted the automation of the thinking apparatus. However, regressively because of similar economic factors, it has led to clang associations, slogan ideation, and magical generalizations where similarities are hypercathected at the expense of discrimination.

The earlier psychoanalytic writers looked upon symbolization almost exclusively in the way that it was related to the dream and the symptom. As such, it was generally thought of as both a primitive and malevolent process.

Ferenczi (1) defined symbols as "such ideas as are invested in consciousness with a logically inexplicable and unfounded affect and of which it may be analytically established that they owe this affective over-emphasis to unconscious identification with another idea to which the surplus of affect really belongs". Ferenczi went on to say, "only what is repressed is symbolized; only what is repressed needs to be symbolized".

Rank and Sachs (17) considered symbolic function as a regressive phenomenon, stating that it "remains a reversion to a certain stage of pictorial thinking . . . most plainly seen in those exceptional conditions in which conscious adaptation to reality is either restricted as in religion and artistic ecstasy or seems to be completely abrogated, as in dreams and mental disorders".

Jones (9) remarked, "Symbolic modes of thought are the most primitive both ontogenetically and phylogenetically and represent a reversion to some simpler and earlier stage of mental development." He would separate this function from "indirect representation" which is related to learning, communication, abstraction, etc.

Kubie (12) has taken exception to this concept of symbolization as used by the earlier authors as purely regressive, primary process activity. He emphasized that the distinction made by Jones between indirect representation and symbolization was a misleading one. He reminded us that the potentialities that cause man to develop a a neurosis or psychosis are also essential to his highest psychological achievement. Kubie described a gradation of symbolic representations from the infantile to those of maturity. He stated as follows (13), "In all dissociated processes (such as sleep, the hypnagogic toxic states, and fatigue) we drop back from mature levels of conceptional development (in which concepts and their symbols are relatively distinct from one another) to earlier levels (in which concepts and their related symbols overlap). This is an inevitable ontogenetic basis for certain of the characteristics which are common to the language of the dream and to psycho-pathological phenomenon in general."

Rycroft (19) follows Kubie in the more inclusive view of symbolism. He states that symbolism is neither inherited nor is it exclusively "the language of the uncon-

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scious". It can be used by the primary or secondary process.[2]

Melanie Klein (10) wrote that symbolism is the foundation of all sublimation and every talent. She stated it is via the mechanism of symbolic equation that things, interests, and activities become libidinized. According to her theory, the child desires to destroy the organs (penis, vagina, breast) which stand for the objects. He suffers severe anxiety in regard to these organs which lead him to equate the organs in question with other things. These "other things" then become objects of anxiety which makes him shift to other things and to make new equations. This forms the basis of interest in new objects.

A systematic study of symbolism in a psychoanalytic treatment was reported by French (4). In 1936 he noted the change in form of symbolism in the manifest content of dreams. At that time he viewed the problem of this change in an economic way. In an effort to deal with childhood conflicts, cathexis is withdrawn from them and the pertinent figures are as if "deprived of life". French stated, "Living persons can be replaced by inaminate dead objects. It is already a first step in the process when human beings are replaced by smaller animals. When the process of withdrawal of cathexis from the childhood conflicts has gone further, human beings can be replaced by inaminate objects without much dynamic quality...." French spoke of calcified impersonal symbols without dynamic quality (like the cake and oven) in contrast to dynamic symbols like a threatening fire. Later again studying the symbolic process in this way, French (3), in *The Integration of Behavior* showed the cognitive structure of the dream.

Kubie's theoretical constructions and French's systematic clinical studies as noted above serve as points of departure for the present communication. A case in analytic treatment by virtue of her rich fantasy life, especially using animals, gave evidence for Kubie's hypothesis of gradations and levels of symbolic functionings. It was further felt that changes in the symbolic process, most often regressive, were not only part of the pre-analytic neurosis but were induced by the psychoanalytic technique itself. Macalpine (15) has also reminded us that the patient does not fall into the regressive transference but is encouraged into it by the psychoanalytic technique itself as part of the therapeutic goal. In this regard she has written, "Psychoanalytic technique creates an infantile setting of which the 'neutrality' of the analyst is but one feature amongst this. To this infantile setting the analysand—if he is analyzable—has to adapt albeit by regression. In their aggregate, these factors which constitute this infantile setting amount to a reduction of the analysand's object world and denial of object relations in the analytic room. To this deprivation of object relation, he responds by curtailing conscious ego functions and giving himself over to the pleasure principle, and following his free association, he is thereby sent along the trek into infantile reactions and attitudes".

Outside of French's work where the emphasis was on the dream structure and integretive process therein, one searches in vain in the literature for a systematic study of the symbolic process in an active and continuing therapeutic situation. Saul and Sheppard (20) have used the manifest content of dreams from two hundred subjects in an attempt to quantify emotional forces. However, no study in this regard of one or more cases in psychoanalytic treatment was undertaken. (Dr. Walter Hamburger of Rochester, New York presented a study of the symbolic process related to the occurrence of food and eating in dreams. This paper was presented to the Chicago Psychoanalytic Society in November, 1956.[3]) It is

[2] It is surprising how often the role of secondary process activity is overlooked in dreams.

[3] Later published. Hamburger, W. The occurrence and meaning of dreams of food and eating. Psychsom. Med., **20**: 1–16, 1958.

hoped that the following presentation will shed light on the dynamics of symbolism.

The reader will recognize that a basic premise in this investigation is the acceptance of the dream as a cognitive structure as elucidated by French. Also, for this study of the symbolic process, the manifest content of dreams becomes invaluable source material. There is, however, no lack of associative material which leads to an understanding of the latent dream meaning. Integrative and other functions are inextricably involved here but will not be the primary concerns in this study.

The patient was a twenty-seven year old white female who sought treatment because she felt she was a misfit in the world. She was plagued by recurrent depressive episodes of moderate severity and felt that she was constantly running away from significant human relationships. She had a general feeling of hopelessness about the way she was drifting. She felt that she had some hidden desires to lead the life of a woman but found herself intensely uncomfortable in the feminine role. She described herself as being paralyzed when she found herself directed toward marriage and a family life. She dated the onset of her disdain for femininity to the age of eleven when she watched her two and a half year older sister suddenly develop into womanhood with the onset of menstruation and secondary body development. She stated that she felt terror stricken at the thought of such a thing happening to her and at that time resolved that she would have none of it. Thereafter the tomboyishness of the latency period did not end for her but was actually strengthened. She spent her adolescence in a triumvirate relationship with two boys her own age. Together they hunted and fished, went on expeditions in the forests and up rivers, stole chickens, raced motorcycles and partook of all the adolescent exhibitionistic masculine protest activity open to her. She prided herself that she could surpass the boys in all of these activities. In addition, at the age of twelve, she became intensely interested in animals and wild life. She fancied herself a "child of the wilderness." Her fondness for dogs and horses increased; she raised, trained and later exhibited them at shows. At one time she also trained hawks. All of this with much exhibitionism. She described her great pleasure in speeding through the main street of town in an old touring car with a 200 pound St. Bernard dog at her side.

There were minimal contacts with men on a heterosexual level; she would run away when a boy became romantically inclined. After her sister was married, the patient entered in a homosexual relationship with an older woman with whom she started a kennel business. This relationship proved a failure and just prior to her entering upon treatment she became enamoured of a teacher at a local college. He had been married before and his marriage ended because of his strong paranoid trends which he developed when his wife became pregnant. Since then, he was prone to repeated regressive episodes but was able to function satisfactorily at the college. The patient submitted to him in her first heterosexual relations only after he demanded sexual intercourse for the sake of his health.

Genetically, as the history unfolded, it became apparent that both of her parents had a great need for a male child. The patient was born when the mother was forty-one. This last hope, lacking fulfillment, led to despair. Following this birth, the father, a podiatrist by profession, gave up his work and has been supported by his wife ever since. The patient recalled that in her early childhood she had a very close relationship to her father. At the age of six, however, a separation occurred wherein the mother and the two children went abroad for nine months. On the return the patient's relationship with the father had changed. Apparently as she was growing up, the sexual threat to the father increased and the tenderness that was formerly present was

replaced by isolation and negativism. Between father and daughter there was constant provocation and "rough house" contact, analogous to that described by Rappaport (18). The provocation would lead to a great deal of acting out behavior, often with the father so enraged that he would chase her around the house brandishing a knife.

With her mother she related with almost total submission; in turn her mother offered protection and assumption of total responsibility. Patient recalls asking her mother where her "will" was. The mother responded: "Here in my pocket where it will remain". Mother had had two pregnancies in spite of a severe pelvic deformity. With the father's inability to make a living, the mother took over this function by raising chickens and having boarders in the house.

Without going into the details of the anamnesis, it can be stated that the focal conflict of the patient was between her feminine strivings and her need to meet an ego ideal goal of masculinity as unconsciously demanded by the parents. The patient's attempted solution was the classical masculine protest reaction which also served as a defense against oedipal fears and strivings. She fancied herself a man or certainly as good as any man. She suffered acute anxiety when realities interfered with or counteracted this construction. Later it became apparent that she suffered from rage reactions secondary to the frustration of her deeply hidden feminine strivings.

In the early stage of therapy, it soon became clear that her presenting motive for therapy, to paraphrase Freud, was that through it she might magically attain a penis and forever quell the demands of a seemingly insatiable ego ideal. The importance of this striving and the shame and anxiety that go with it have recently been restated by Piers and Singer (16), "Shame then occurs whenever goals and images presented by the ego ideal are not reached ... behind the feeling of shame stands not the fear of hatred, but the fear of contempt which, in an ever deeper level of the unconscious, spells fear of abandonment, the death of emotional starvation."

In this regard, her dress and manner betrayed her masculine strivings. She disdained the secretarial jobs which she was forced into in order to make a living. She constantly ridiculed her employers with great disparagement. With her paranoid paramour, the symbiotic relationship permitted her to play the masculine role, and likewise be protected from ideas of marriage.

One of the interesting aspects of both her real and fantasy life was the part played by animals. As noted above, the patient had numerous animals as pets, and later owned a dog kennel. Her language contained innumerable anthropomorphic and animistic forms. She speaks in terms of putting the "feed bag" on, of "scrounging around for clothes to wear". She admired her boy friend because he was "hawk eyed." She continuously expressed her love and devotion to her animals. However, she would often gather too many around her and could not afford to feed them. Then she would have to have many exterminated. This was a pattern that kept repeating. However, there was always a personal animal which she had with her, usually a male dog who was quite ferocious and who could not be fed or cared for by anyone but the patient. The pattern was evident: she would love the animals, then could not care for them, and would have to kill them. These macabre episodes were repetitious and demonstrated her intense ambivalence and limited object cathexis. It later became evident that her relationship to animals showed both the reaction formation of love and the return of the repressed in which the destructive impulse was gratified through "mercy killing" of them. She was thus acting out her identification with the mother who took responsibility for everything. The patient treated her animals the way she felt her mother had

treated her in the mechanism of hostile identification with the aggressor as described by Anna Freud (5). Because of the intense affects associated with the parents and sister, the family drama had to be reinacted by substituting animals for human objects. Most pertinent to the present study was the appearance of animals in the manifest content of her dreams. It was felt that the appearance of this content connoted regressive tendencies associated with both the pre-existing neurosis and the treatment itself. Samplings of these tendencies and changes will now be presented from this psychoanalytic treatment.

The first dream of the analysis was reported by the patient in the 20th hour. "Jim and I were in a jungle. He was suffering from a heinous disease which caused him to shrink. His legs were all shrivelled up. One was practically gone; the other was no bigger than your arm. I was carrying him piggy-back. I put him down every so often and rubbed the remaining leg. I knew full well that he was going to die but we were both trying to pretend that neither knew what the situation was. I tried to say that we would both be all right as soon as we got out of the wilderness. When I put him down the last time, he died."

There were no direct associations to this dream but in a sense the remainder of the analysis was associative material. The full meaning of the dream revealed itself and became understandable only much later when data had accumulated. It then was apparent that in the initial dream she was expressing her principal focal conflict. She was burdened by the hopeless load of a sick, deformed withering ideal of masculinity, already with some realization that this would have to be abandoned somehow if she was to survive. Jim, her paranoid friend, in reality represented the externalization of her deformed and unconsciously hated masculine ego ideal.

So much for the "meaning" of the dream. Our interest here centers on the symbolic process. In this first dream of the analysis, there are indications of what may be called "mature" symbolization.[4] It gives evidence of the presence of a reflecting and observing ego. It is allegorical in nature and might be considered to have pre-conscious cathexis. The burden that one carries on one's shoulders is a recurrent and cliched poetic form. On is reminded of John Bunyan's *Pilgrim's Progress* wherein Christian is depicted as trudging through the slough of despond with his worldly burden. In addition there is a personification of her conflict with verbal communication.

The next dream occurred in the 27th hour and was reported as follows. "Jim had gone away. I stopped at his house. When I entered, the whole place was billowing with women's and little girl's clothes. I figured

[4] One might speak of symbolization as primitive or mature in two senses. In one, as used by Kubie, mature symbolization would be characterized by concept and symbol being relatively distinct from one another. For example, the "stars and stripes" is a *flag* of the United States. This type of representation would be deemed as mature. However, to think of the "stars and stripes" as *being* the United States would indicate an overlapping of concept and symbol. This would be primitive symbolization.

In the present study, mature symbolization as apart from infantile or primitive, is used in a second but related sense. Here one is concerned with the choice of symbols to represent objects or feelings. For instance, patient A dreams of his father as a degraded or exalted man. Patient B dreams of his father, but represents him as a St. Bernard dog. Why the difference? The choice of doing either is open to both of them. It is postulated that patient A, in using a human form to symbolize his father, has shown that his relationship to objects at that time is of a more mature order than patient B who can no longer think of the object in human terms. The symbolization of patient A is dominated by secondary process thinking—that father may be good or bad, with or without animal traits, but he is after all a human being.

Patient B displays predominantly primary process activity, to wit, "Father, to me, is big, docile and dumb; dogs are big, docile and dumb; so father is a dog." As an extension of the absurdity of primary process thinking, "If father is a dog, then a dog can be father, trailing after me and doing my bidding", as in the history of the present case. Here one can abandon the task of relating to human beings and solving the problems thereof.

they had belonged to his wife and little girl. I felt very badly that he had dragged these things out and was kind of living with them. It wasn't very logical; they were all new. Some of them had price tags still on them. The child's clothes were those of a six-year-old".

In symbolic content, this dream closely resembled the first in that there is both observation and active reflection on her problem. There is hope that the masculine defense can be abandoned and the still unused femininity might come forth. Also, there is recognition of the "feminine nature" of paramour. In these analytic hours, there was minimal activity on the part of the therapist. As the analysis proceeded, she began expressing increased animosity toward her mother who always talked but never listened. At the same time she spoke disparagingly of her inept father, who seemed to be a dead weight around the house. At this time patient was living with her parents and commuting to the city, 60 miles daily for therapy. This arrangement fitted in well with her masculine protest defense, and was pointed out to her. She moved to the city with much anxiety and anger toward the therapist for making her leave the healthy and serene country for the "dog eat dog" atmosphere of the city.

It was apparent in this period that the analysis was proving to be a frustrating and fearful experience for her. What she got from mother was not forthcoming in the analytic situation. Mother's garrulousness was replaced by a listening therapist whose main object now appeared to be "clipping her wings".

In the 60th hour she reported a dream in which she described as nightmarish in quality. "It was a cold bleak night. I was outside of our house. I saw a pack of wolves, teeth and fangs bared; father was walking towards the house unaware of the danger. I grabbed him and pulled him into the house. I tried to shut the door but each time I shut it and felt we were safe, we were on the outside again. This kept recurring again and again. I could see the white teeth of the wolves, and they were frothing at the mouth. I woke terrified."

In association she remembered that it was "just like her father. He would be too preoccupied with his fantasies, day dreams, and schemes to be aware of what was going on around him. It would be up to mother or me to do things. And why was he worth saving? He is really less than the wolves. At least a wolf is a good provider for his young ones; pop "conked" out completely on that score."

Here her masculine complex activity was asserting itself, but the anxiety about her oral destructive feelings towards her father were likewise mounting and threatening to get out of control. The wolf represented both her masculine and destructive feelings which she sought to hide by way of rescuing her father, actually from herself.

The presence of animal forms in the manifest content continued. She was chased by herds of cattle and at other times by stampeding horses. In the 100th hour she related the following. "I dreamed about a horse with a terrific sense of humor. A woman, slender, white haired, was reading a newspaper. The horse would start up a slope, then turn around and whinny. He wasn't getting the attention he wanted from the woman who was reading the newspaper. He then proceeded to deposit a huge "pile" right in the middle of the newspaper. The woman opened her mouth and "God damned", continuing to read the paper." Here there is evidence of teasing and provocation—an effort to get a rise out of the therapist as she had done with father.

Another therapy-related dream appeared in the 120th hour. "I was at the kennels, training dogs. There was one dog I was training to crap. As I hammered a stick on the ground, he would crap out cardboard boxes—every time I'd pound the ground

another would come out. I would then feed it back to him again. I would grunt but wouldn't have to say a word".

At this point in the analysis, the patient was experiencing intense anxiety about the treatment process itself. The use of the cardboard notebooks and "frantic" recordings of the therapist, the long periods of silence were quite terrifying to her in spite of her external veneer of masculine bravado. In this dream she handled her terror by regression from human to animal forms, and also by reverting to gesturing; there was an absence of speech. This was a striking example of what might be termed "regression induction" due to the active forces of the analytic process.

There next appeared a succession of dreams in which memories, fantasies, and feelings were being re-experienced but again in animal forms. In one dream a polar bear with a bone in his penis had mounted and was penetrating her St. Bernard dog. She was awakened seemingly by the sounds of agony from the dog. There was collaborative evidence that this was a primal scene fantasy.

In another dream her St. Bernard was chasing a mouse with "claws and fangs" bared and in the process ripped up the walls and furnishings of a green painted room—later identifiable as the treatment room. In this period of the analysis, the dreams reported predominately involved animal forms. Interspersed with them, however, was a "resurrection" type of dream in which the patient visualized herself with an adolescent youth who had been killed a few years before in a forest accident. In these dreams they were together again, or he was back with his mother, or he was about to be engaged to another girl. It appeared that the manifest content dealing with the adolescent period was a compromise and escape from both the dreaded infantile experiences and their recrudescence in the present analytic situation. In these dreams there were also restitutive attempts to relieve guilt feelings about fantasies of castrating males; she repeatedly returned the boy to his mother.

Dreams on two successive nights gave evidence of her phallic conflict and hidden sexual theories. The first dream was as follows. "Jim and I were on a vast expansive bed and sort of fondling each other. I was aware of the fact that mother was sitting in the next room with her back to the door that was open. I looked down and saw that I was sprouting a long slimy penis affair, at the same time bleeding profusely from the genitals. I felt annoyed at this thing happening but I seemed to attribute this to an extraordinary degree of stimulation that caused this thing to involuntarily come out." The next night she dreamed of a large rabbit like Harvey, but equipped with a full set of antlers. "Jim then appeared in the dream and said that he was the rabbit and that he was coupled. He went on to explain that they would put horns on a fellow when a woman made a goat out of him." In association to the latter dream, patient felt that the rabbit indicated fecundity to breed like a rabbit. The antlers made it a fighting, protective animal as well. She stated this is like mother—she gives birth and yet she has to give protection too. She had to be everything. "Jim is afraid of getting coupled though I would never force him into anything."

These two dreams seemingly are attempting to deal with the roles each of the participants was assuming. The patient in fantasy was playing a masculine role. The paranoid boy friend, although customarily maintaining a superficial masculine bravado, clearly abrogated his masculinity and submitted to her sexually. His homosexuality could thereby be gratified through her.

In the first dream of this pair, the unfolding of an infantile sexual theory becomes manifest, *i.e.* that a penis is really there within her and will come out under sexual stimulation. In the first dream she is able to

see herself as such with her friend and mother. This apparently caused intense anxiety, and the following night a dream with a similar latent meaning was produced; this time, however, with a regressive animal form. The appendage sprang forth from the head of the rabbit, displaced upwards.

Following a period in which large animals; horses, bears, and dogs predominated in the manifest content, the patient reported a number of dreams in which smaller animals and birds appeared. The following is a striking example. "I was riding on a bus with a boy I knew years ago. I was sitting next to him. Suddenly he turned partially into a bird. His nose became a beak and his lower extremities like the feet of a hawk. His trunk remained unchanged. I woke frightened. She identified the bird man as like her hawk eyed boy friend. It was evident from further associations that the dream occurred in response to an intensification of her conflict with him. She was becoming increasingly aware of the predatory nature of their relationship. Hawks are vicious, hard to train and feed on live animals. In the dream she attempted to relieve her own feelings of guilt by giving her boy friend the hawklike qualities and seeing herself as the live victim.

During these analytic hours, the form of the symbols was quite actively dealt with. She was made aware, through interpretations of the dreams and her own acting out behavior, how she used animals as substitutes for both people and parts of herself (anatomical and emotional). It was pointed out to her this resulted from shame about her interpersonal relations and that the intensification of these feelings were coming about due to treatment and her relationship to the therapist.

Only after repeated interpretations of this nature, did a diminution of the animal forms occur. They were replaced by human forms with appropriate communication between them. However, in spite of evident progress in the analysis and maturity of this individual, the animal forms recurred from time to time concurrently with feelings of rage and shame.

It should be noted that the required description of this transaction necessarily suffers because of the condensation required for this report. In this case the intervention of the analytic experience plus an exposure of the relationship to her parents with concomitant affect release, although ultimately helpful, was reacted to by a regression which extended to the symbolic process. Interpretation of the affect as well as the nature and mechanism of the symbolism was then followed by a shift to a higher level of symbolic function.

An example of material occurring later in the analysis will now be given. The treatment had been proceeding with a "mother transference" dominating the relationship. The patient's productions by the 400th hour alternated between masculine protest reactions, which were now definitely on the wane, and explorations of feminine feelings and attitudes, with a constant testing of the analyst to see if she could really be accepted by him as a woman. Progress became apparent in her day-to-day living, as evidenced by loosening of the bonds of (latent) homosexual relationships, lessening of her need to disparage eligible men, and insight into her masculine identity. Toward the therapist there persisted a need to deny erotic feelings throughout the analysis in spite of its appearance in the dream material. She dealt with this aspect by acting out with her boy friend. This served as one of the chief resistances in the treatment. By the 600th hour oedipal material, regressively expressed, became evident in a dream and its interpretation gave rise to animal symbolism once again. This will be described in the following account of sessions 609–611. In the 609th hour, after a weekend visit to the home of her parents, she reported the following two dreams occurring in the same night.

The first dream was described as follows.

"I got involved in a dance troupe. I protested I knew nothing about dancing. It was a chorus routine that they did. Vague feelings that mother wanted me to be there; that it would do me good. Everyone was dressed in tights and we were all living in trailers. There was no such thing as privacy. I was sitting on the john—with a bunch of girls around—privacy simply wasn't part of the set up. A man came in with a letter supposedly for me or concerning me. The man was tall, thin, with dark horn-rimmed glasses. He had a mustache. I was startled for a moment being on the john. He poohpoohed it—said if we were all going to be living together intimately we might as well forget conventions."

The second dream of the same night was thus described. "We were standing in a long line of some sort. Jim was behind me and jammed tight up against my back. I was standing bent forward with my tail sticking out. Mother was around somewhere but I kind of wiggled intimately with Jim. I could feel him stiffening and I continued to wiggle. Mother appeared. She had been involved in this interchange. She went on at some length at the danger involved bringing any pressure to bear on the female genitals. She then accused me of having hit her in the genital area and further admonished that what I was doing wasn't sex." From the association, it became evident that the man in the first dream was a composite of the analyst and the patient's father. In the dream she acknowledged that her relationship with Jim was pregenital and anally directed. Her genital region awaited the man from the first dream. The homosexual defense and the accusation about genital injury involving the mother also revealed itself. To this material, the interpretation was made that sexual feelings toward the therapist were emerging which she tried to hide through her activities both with Jim and her mother. She became silent and later protested that no such feelings toward the therapist existed and if they did, she would never admit them.

In the next hour, the 610th, she reported the following dream which disturbed her. "The dream started with a horse and a cat: both seemed to belong to me. They acted demented—with no control. They would go into spasms and peculiar gyrations. My dog and I were watching. Apparently the cat had bitten the horse. I was worried about the possibility of the dog going the same way too." In her associations to this dream, she indicated her childhood and adolescent love of horses. "And, if you couldn't have a horse, a dog would do. Cats would be poor substitutes for dogs." Dogs have remained with her as companions and trusted friends. It became apparent that the cat symbolized destructive, possessive femininity, and the horse represented the male and male organs. The dog was a medium-sized product of the small and large animals. In the light of the dream and the interpretation of the previous day, she expressed regressively the intense intrapsychic struggle, including fears of her own oral sadistic feelings in an intimate relationship. The dog is revealed as a protection against selfishness and destructiveness—truly the watch dog. Here it was felt that the interpretation of the previous dream dealing with the oedipal conflict led to the second dream where human forms were replaced by animals.

Heiman (6) in a recent study of man and dog indicated that a dog may serve as a factor in the maintenance of psychological equilibrium. The present study bears out his statement that the "dog is of service, especially in women, in sublimating preoedipal instinctual drives, particularly cannibalistic ones, also oedipal drives."

In the following session, the patient indicated she was breaking off with her paranoid boy friend. She expressed the futility of the relationship with him and stated that she would attempt to go out with more eligible men although the prospect frightened her to death. Her activity in reality plus the transference interpreta-

tion, although ultimately corrective in nature, brought forth again regression in the symbolic process in an attempt to deal with overwhelming superego anxiety.

DISCUSSION

We have noted changes in symbolic activity from mature to infantile or primitive levels in a patient under analysis. It was felt that this movement was in response not only to the preanalytic neurosis but was affected dynamically by the stresses of the psychoanalytic technique.

The question arises as to the criteria that one is justified in using to differentiate nature symbolization from less mature and infantile forms. Kubie (13) has stated that in the immature there is an overlapping of concept with its symbol; in the mature, concept and symbol are distinct. For clinical purposes the differences can be stated in a general way and like other aspects of movement of processes in the psychic apparatus, they follow ontogenetic lines. If we follow Lewin's (14) hypothesis, the manifestation of the most intense regression would be the "blank dream" where the blank represents the visual memory of the breast. Isakower (7) in dealing with toxic or predormescent states describes subjective sensations of infancy which are visually perceived as shadowy, indefinite, changing objects.

Primitive symbolization would be characterized by a gross exaggeration of similarities at the expense of psychical two-point discrimination. In the manifest content, there are gross animistic and anthropomorphic tendencies. There may be an absence of human beings and human qualities; these being replaced by animals and inanimate objects. Instead of speech, there may be gesturing or still more primitively direct sphincter or orificial expression. There may be "centaur" forms. Or, again, human organs or parts may be represented. These may be indicative of a part object relationship and its cathexis as described by Klein (11).

In contrast to the primitive forms, mature symbolization in dreams is characterized by the use of speech, ideas, formulations, distancing, and other evidence of sublimatory activity. The manifest content reveals communication between *persons*, albeit in disguised form with displacements, condensations, etc. Likewise, sphincter expression appears in sublimated form—allegory is present to a great degree.

For ontogenetic evidence of this thesis, we turn to Ferenczi's (2) classical paper entitled "Stages in the development of the sense of reality." Here Ferenczi described the earliest stage of symbolic activity as follows. "Everything points to the conclusion that the child passes through an animistic period in the apprehension of reality, in which object appears to him to be endowed with life and in which he seeks to find again, in every object, his own organs and their activities.

"The derisive remark was once made against psychoanalysis that, according to this doctrine, the unconscious sees a penis in every convex object and a vagina or anus in every concave one. I find that this sentence well characterizes the facts. The child's mind (and the tendency of the unconscious in adults that survives from it) is at first concerned exclusively with his own body and later on chiefly with the satisfying of instincts, with the pleasurable satisfactions that sucking, eating, contact with the genital regions, and the functions of excretion procure for him; what wonder then, if also his attention is arrested above all by those objects and processes of the outer world that on the ground of every so distant resemblance reminded him of this dearest experiences.

"Thus arose those intimate connections which remain throughout life, between the human body and the objective world which we call symbolic."

Ferenczi's elucidation of stages in the development of the sense of reality gives us a prototype for the study of levels of symbolization that take place in normal ontogenesis which may be retraced in the dream of the adult. It may be possible to ascertain, both diagnostically and prognostically, states of fixation and regression from the level and nature of the symbolization of the dream and more particularly of a cluster of dreams.

SUMMARY

A systematic study of the symbolic process during a psychoanalytic treatment is presented. Levels of symbolization from mature to primitive are postulated, as shown in shifts from human to animal to inanimate forms in the manifest content of dreams under pressure of regressive forces. The subject of the present analysis appeared to displace affects to animals both in real life and in dreams because of terrifying object relations.

REFERENCES

1. Ferenczi, S. On eye symbolism. *Sex in Psychoanalysis*, Ch. 10, pt. 2. Basic Books, New York, 1950.
2. Ferenczi, S. Stages in the development of the sense of reality. *Sex in Psychoanalysis*, Ch. 8. Basic Books, New York, 1950.
3. French, T. M. *The Integration of Behavior*, v. 1. Univ. of Chicago Pr., Chicago, 1952.
4. French, T. M. A clinical study of learning in in the course of psychoanalytic treatment. Psychoanalyt. Quart., **5**: 148–194, 1936.
5. Freud, A. *The Ego and the Mechanisms of Defense*, Ch. 8. International Universities Pr., New York, 1950.
6. Heiman, M. The relationship between man and dog. Psychoanalyt. Quart., **25**: 568–585, 1956.
7. Isakower, O. A contribution to the patho-psychology of phenomena associated with falling asleep. Internat. J. Psycho-Analysis, **19**: 331–345, 1938.
8. Jones, E. The theory of symbolism. *Papers on Psychoanalysis*, Ch. 3, 5th ed. Bailliere, Tindall and Cox, London, 1948.
9. Jones, E. The genesis of the super ego. *Papers on Psychoanalysis*, Ch. 4, 5th ed. Balliere, Tindall and Cox, London, 1948.
10. Klein, M. The importance of symbol-formation in the development of the ego. *Contributions to Psychoanalysis*, pp. 236–250. Hogarth Press, London, 1948.
11. Klein, M. A contribution to the psychogenesis of manic-depressive states. *Contributions to Psychoanalysis*, pp. 282–310. Hogarth Press, London, 1948.
12. Kubie, L. S. Body symbolization and the development of language. Psychoanalyt. Quart., **3**: 430–444, 1934.
13. Kubie, L. S. The distortion of the symbolic process in neurosis and psychosis. J. Am. Psychoanalyt. A., **1**: 59–86, 1953.
14. Lewin, B. D. Sleep, the mouth and the dream screen. Psychoanalyt. Quart., **15**: 419–434, 1946.
15. Macalpine, I. The development of the transference. Psychoanalyt. Quart., **19**: 501–539, 1950.
16. Piers, G. and Singer, M. B. *Shame and Guilt*, p. 14. C. C. Thomas, Springfield, Illinois, 1953.
17. Rank, O. and Sachs, H. *The Significance of Psychoanalysis for the Mental Sciences*. Nervous and Mental Disease Pub. Co., New York, 1915.
18. Rappaport, E. A. The management of an erotized transference. Psychoanalyt. Quart., **25**: 515–529, 1956.
19. Rycroft, C. Symbolism and its relationship to the primary and secondary processes. Internat. J. Psycho-Analysis, **37**: 137–158, 1956.
20. Saul, L. and Sheppard, E. An attempt to quantify emotional forces using manifest dreams; a preliminary study. J. Am. Psychoanalyt. A., **4**: 486–502, 1956.

PERSONALITY DETERMINANTS OF MEDICAL CLINIC CONSULTATION

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In an earlier paper (5) we reported that students with a large number of somatic complaints did not seek medical consultation significantly more frequently than did students with a low number of somatic complaints. We concluded that bodily concern *per se* was not a significant factor in motivating medical consultation for relatively minor complaints. Summerskill and Darling have shown that, in a student population, the frequency of clinic attendance for respiratory infections is significantly related to religious affiliations and to college of enrollment and have speculated that cultural background is an important factor (8). The present study is an attempt to define further what motivates people to seek medical assistance for seemingly trivial somatic distress.

The hypothesis tested in this study, that persons rated low in self-acceptance would apply for medical care more frequently than persons rated high in self-acceptance, is derived from the general context of self theory (1, 9, 10). Sarbin, in an excellent analysis of the development of the self, has observed that, "... the first perceptual organization of the infant is probably in relation to the modes of restoring homeostatic imbalance at the physiological level." (6, p. 14). Thus, for example, the colicky infant solaced by the loving mother may, through such experience, begin the formation of rudimentary attitudes of value in relation to his own body. Later, as his parents and others respond to his illnesses, his appearance and his physical achievements with value judgments of their worth, he extends and deepens his attitude toward his body as a part of himself. An integral part of self theory, then, is the notion that "somatic self" percepts lie at the core of self-organization. This was recognized by Freud in his observation that the ego is first and foremost a body ego (4).

The present investigation is based on the premise that changes in self-perception of a pervasive character will include changes in the perception of the "body image" and that when self as a whole is assigned a low value so too will percepts of the body. In other words, the person doubting his value as a person will also have doubts in regard to the integrity and capacities of his body.

METHOD

A measure of expressed attitudes of self-acceptance was administered to one hundred and eighteen students at the time of admission to the University of Wisconsin. The self-acceptance scale which was employed as the criterion measure had been used in previous studies (2, 3) with demonstrated value. The scale consists of twenty statements which describe self attitudes. Some sample statements are: "I'm a pretty relaxed sort of person", "I'm not the person I pretend to be", "If people knew what I'm really like they'd be disappointed". The subject is asked to indicate the degree to which the statement applies to him by selecting the appropriate point on a continuum from one (almost always) to five (very rarely). All of the subjects received complete physical examinations and a complete medical history on the same day as the test administration and all were found to be essentially free of symptomatology.

Six months later the self-acceptance scores of thirty-six of these subjects who had sought one or more consultations in the

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Student Health Clinic were compared with the scores of thirty-six controls, matched for sex, age and education level, who had not applied for medical treatment during the first semester. There were twenty males and sixteen females in each group. The average age for the experimental group was 18.8 years, the average age for the controls was 19.0 years.

In order to provide independent clinical validation of the self-acceptance measure in the hypothesized relationship to medical clinic attendance, the first semester medical records of sixty-one students whose later histories indicated that they had made a suicidal attempt were compared with the medical records of a like number of randomly selected controls. In this facet of the investigation low self-acceptance was operationally defined in terms of the suicidal attempt.

RESULTS

The mean self-acceptance score for the group that sought medical treatment was 71.67 with a range from forty-six to eighty-six. For the control group the mean acceptance score was 75.06 with a range from fifty-seven to eighty-six. Analysis of the significance of the difference of the self-acceptance scores between the two groups was performed by means of the non-parametric Wilcoxon matched-pairs signed-ranks test (7), and the results permitted rejection of the null hypothesis at beyond the .02 level of confidence.

For the suicidal attempt group the mean number of first semester medical visits was 6.5 with a range from zero to forty-three visits. The mean number of visits for the controls was 2.8 with a range from zero to fourteen. A t-test of the difference between means indicates statistical significance at beyond the .001 level of confidence.

DISCUSSION

It has been demonstrated that, in a student population, a clear relationship exists between self-acceptance and the frequency of medical visits. In interpreting this finding an important consideration is the degree to which it can be validly generalized to populations more heterogeneous in age and socio-economic background. We suspect, though this remains to be demonstrated, that it will apply as accurately to more general populations.

It cannot be concluded with certainty, of course, that the demonstrated relationship is a causal one—that low self-acceptance motivates the search for medical assistance. We believe that such a relationship is strongly suggested, however, by a fact related to the design of the study. At the time the measure of self-acceptance was administered, the subjects were not suffering from any symptoms nor were there any physical findings indicative of pathology, yet they nonetheless sought consultation in the clinic subsequently.

It is possible that bodily distress *per se* results in a lowering of self-esteem and this is a subject of research currently in progress. Such a possibility would not, however affect the results of this study because at the time the self-acceptance measure was administered the subjects were not experiencing bodily distress or at least did not report it if they were.

The critical reader may suspect that the group rating low in self-acceptance is suffering from definable psychiatric illness and that the complaints which they presented were therefore largely anxiety referents. Examination of the data on the nature of the complaints does not support this possibility, however; twenty-five per cent of the complaints were respiratory infections, twenty per cent were minor injuries and infections, with twelve per cent at most interpretable as physiological expressions of anxiety.

A critical question with relation to these findings is whether the theory from which the hypothesis was derived is supported. Though Schilder, Sarbin and others were

astute and careful observers we believe that there has been a paucity of rigorously designed studies testing the theories which they derived so creatively from their clinical observations. We believe that this study has lent some modest and objective support to these theories.

At the clinical level it would seem that these findings emphasize once again the need for every physician to be aware that his services are sought to allay distress of the whole person, that no useful dichotomy exists between mind and body and that patients themselves do not make such a distinction in seeking help. Specifically, the results of this study support the wisdom of seeking alternative explanations when little or no somatic pathology is found; a symptom is a symptom of *something*.

SUMMARY

The hypothesis, derived from the context of self theory, that individuals rated low in self-acceptance would apply for medical care more frequently than those rated higher in self-acceptance was tested. A measure of self-acceptance and, independently, a history of suicidal attempt were employed as the psychological and behavioral criteria of self-acceptance. The results confirmed the hypothesis at appropriate statistical levels of confidence. Some theoretical implications of these results are discussed.

REFERENCES

1. Allport, G. W. The ego in contemporary psychology. Psychol. Rev., **50**: 451–478, 1943.
2. Fey, W. F. Acceptance of self and others, and its relation to therapy-readiness. J. Clin. Psychol., **10**: 269–271, 1954.
3. Fey, W. F. Acceptance by others and its relation to acceptance of self and others: a reevaluation. J. Abnormal and Social Psychol., **50**: 274–276, 1955.
4. Freud, S. *The Ego and the Id*. The Hogarth Press, London, 1949.
5. Greenfield, N. S. and Roessler, R. Hypochondriasis: a reevaluation. J. of Nerv. & Ment. Dis. (In press).
6. Sarbin, T. R. A preface to a psychological analysis of the self. Psychol. Rev., **59**: 11-22, 1952.
7. Siegel, S. *Nonparametric Statistics*. McGraw-Hill, New York, 1956.
8. Summerskill, J. and Darling, C. D. Group differences in the incidence of upper respiratory complaints among college students. Psychosomatic Med., **19**: 315–319, 1957.
9. Sullivan, H. S. *The Interpersonal Theory of Psychiatry*. Norton, New York, 1953.
10. Symonds, P. M. *The Ego and the Self*. Appleton-Century-Crofts, New York, 1951.

DAY HOSPITAL CARE AND CHANGING FAMILY ATTITUDES TOWARD THE MENTALLY ILL

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Experience with a mental institution alters the attitudes of mental patients and their relatives both toward each other and toward the phenomenon of mental illness. This paper reports the findings of a study concerned with the relationship between two types of hospital experience, day hospital care and total hospital care, and change of attitude toward mental health on the part of patients and their relatives.

The day hospital was originally designed to meet the serious shortage of hospital facilities for mentally ill persons and to reduce the cost of hospital care. The most expensive form of hospitalization is total hospital or in-bed care. According to one of the pioneers in day care, Cameron, mental patients do not need to stay in bed, nor do they need to stay in such a hospital until they are well (3). An additional advantage of day hospital, as seen by Cameron and others, is that the patient does not have to break with his home, is better able to resolve family problems, and is facilitated in his return to community living (2, 3).

Interpersonal relationships between the mental patient and his family during and immediately after his hospital treatment are of crucial importance to his subsequent readjustment. They provide the practice grounds for his later return to community life. One vital aspect of these interpersonal relationships is the attitudes family members hold toward the mental institution and towards the phenomenon of mental illness. Clinicians and research workers, therefore, are giving increasing attention to the family relationships and attitudes of the individual receiving psychiatric care (1, 4, 5, 6, 7, 8, 9).

The principal subjects in this study were twenty-one matched pairs of psychotic patients. Detailed interviews were conducted with each of the forty-two patients and with two close relatives of each patient, a total of 126 interviews. The interviews were designed to reveal differences occurring over time between day hospital and total hospital patients and their relatives with respect to: 1) attitudes toward family relationships, 2) attitudes toward mental institutions, and 3) attitudes toward mental illness. "Over time" refers in the first instance, to the time period beginning before onset of the patient's overt symptoms and ending at the time of the interview, six to twelve months after the patient's admission to the hospital; and in the second and third instances, to the time period beginning just prior to hospitalization and ending at the time of the interview.

RESEARCH DESIGN

The day population was obtained from the Lafayette Mental Health Treatment Center in Lafayette, Louisiana. It included only patients whose severity of illness was such that the clinical director would have hospitalized them at the time of first evaluation had a day center not been available. The hospital population was obtained from Central Louisiana Hospital in Pineville, Louisiana, ninety-five miles from Lafayette and serving that geographical area. The patients from both institutions were first admissions of the white race, whose stay in the institution was six weeks or longer, and

[1]Southeast Louisiana Hospital, Mandeville, Louisiana. The author is indebted to Dr. Ben Kaplan of Southwest Louisiana Institute for conducting the interviews, to Drs. G. W. Davis, Jr., Joseph G. Dawson, and Frederick R. Hine of Southeast Louisiana Hospital for assistance in selection of the sample, and to Dr. W. L. Kirkpatrick, Director of the Lafayette Mental Health Treatment Center, and Dr. Arthur L. Seale, Superintendent of Central Louisiana State Hospital. This study was financed by a grant from the 1955 Louisiana Legislature, Act 126.

who were admitted during the same three months' period.

The variables used for the individual matching of cases were: 1) diagnosis, 2) severity of illness (as measured by impairment upon admission and duration of overt symptomatology), 3) sex, 4) age, 5) occupation last held, 6) marital status, and 7) position in family in which the individual was presently a member (*i.e.*, grandparent, parent, sibling of parent, child of parent). Matching by diagnosis and severity of illness was done by two psychiatrists and a clinical psychologist on the basis of clinical data furnished by the two institutions. The remaining variables were matched by a sociologist on the basis of demographic data obtained from the two institutions[2].

Patients and relatives were interviewed by a sociologist. A semi-structured interview form was followed and interviews were tape-recorded. Respondents were encouraged to elaborate on their answers as much as possible.

A set of six questions was asked about specific relationships of the patient with members of his immediate family and of the family members with the patient. These questions were asked with reference to two time periods: 1) before onset of patient's overt symptoms, and 2) at the time of the interview. The questions, appropriately phrased, were asked both of the patient and of the relatives. Phrased for the patient at the later time period, they are as follows:

1. Do you feel closer to some family members than to others?
2. Do you enjoy spending time in the home with other family members?
3. Do you enjoy going out with other family members?
4. What kinds of things do you and other family members do together?
5. Are there any things that you and other family members disagree on fairly frequently?
6. Do you feel that other family members carry their share of the responsibilities within the home?

Eight questions were asked regarding the mental institution with which the individual was connected. A ninth question concerned preferences for day or hospital care. The questions as they were phrased to the patient are as follows:

1. Why did you come to the hospital?
2. How long did you wait before coming to the hospital?
3. What did you expect when you came to the hospital?
4. How do you feel about the hospital now?
5. Do you feel that you are being helped or are not being helped at the hospital? In what ways?
6. Do you feel that the hospital takes into account the patient's life with his family outside of the hospital in its treatment program?
7. Do you find any problems in cooperation with hospital requests? If so, what kind?
8. Do you have any suggestions for mak-

[2] The characteristics of the sample are as follows. Thirty-two of the individuals were diagnosed as having schizophrenia and ten were diagnosed as having chronic brain syndromes. Thirty-six of the individuals were severely impaired upon admission and six were moderately impaired. Sixteen of the individuals had shown symptoms for less than a year's time, thirteen from one to five years time and thirteen for more than five years time. As for age, fourteen of the persons were between twenty and thirty-nine years, nineteen between forty and fifty-nine years and nine between sixty and seventy-nine years. Twelve of the individuals were male and thirty were female. Of the twelve males, four were farmers, four were laborers, two clerical and two managerial personnel. Of the thirty females, twenty-five were housewives, three were widows living at home unoccupied, two were clerical personnel. Regarding marital status, four individuals were single, thirty-four were married and four were widowed. Twenty-six individuals were parents living in the home with spouse and children; ten individuals were husbands or wives living at home with no children in the home; one was a single sibling of one member of a married couple, living with that couple in their home; three were children living in the home of their parents; one was a widow living alone; and one was a widow living with an unmarried sibling.

ing the hospital a more effective place? Would you tell me about them?

9. Would you rather be treated at a day care center or at a mental hospital? Why would you prefer one rather than the other? (*N.B.* If the respondent did not clearly understand the difference between the two institutions, it was explained.)

Six additional questions were asked regarding the phenomenon of mental illness. The questions are:

1. How do you feel toward mental illness?
2. Did you always feel this way toward mental illness? If not, what made you change your attitude?
3. What do you feel is the cause of mental illness?
4. Did you always feel this way about the cause of mental illness? If not, what made you change your attitude?
5. Do you feel that mental illness is treatable?
6. Did you always feel this way about the treatability of mental illness? If not, what made you change your attitude?

The six questions on attitudes toward family relationships and the first six questions on attitudes toward the mental institution were rated on a three point scale: +3 on the scale referred to positive feelings, +2 on the scale referred to mixed feelings, and +1 on the scale referred to negative feelings toward family relationships and toward the mental institution. The last three questions on attitudes toward mental institutions were categorized by type of reasons given. All questions on attitudes toward mental illness were rated on a three point scale: +3 on the scale referred to desirable judgments, +2 on the scale referred to partially desirable judgments, and +1 on the scale referred to undesirable judgments on the nature of mental illness. Desirability was rated from a mental hygiene point of view by a sociologist (see Table 6 for ratings of desirability). An independent reliability check on this coding method was made by an anthropologist. Agreement by item on a ten per cent random sample of the material was 87.5 per cent between coders.

TABLE 1

Group Comparisons	Before onset overt symptoms	Attitude change over time
Day Patients and Hospital Patients	ns	T = 52.0*
Day Relatives and Hospital Relatives	ns	ns
Day Patients and Day Relatives	ns	ns
Hospital Patients and Hospital Relatives	ns	ns

* Both day and hospital patients showed change in attitude toward family relationships in a negative direction, but day patients showed significantly less negative change than did hospital patients.

RESULTS

Attitudes towards family relationships. The first set of findings concerns the differences in attitudes toward family relationships between day patients and relatives and hospital patients and relatives[3]. Table 1 presents the significance of the various comparisons made between the four groups before the patients showed overt symptoms of mental illness, and the amount of attitude change from that time to the time of the interview.

Before onset of overt symptoms of illness, all four of the groups had mean scores of 2.5 or 2.3 on the three point scale of positive-negative feelings towards family relationships. Attitude changes over time resulted in mean scores ranging from 2.5 to 2.0 on the scale.

The significance of these attitude changes over time was ascertained for each of the

[3] Wilcoxon *T* tests for paired replicates were run to determine statistical significance between and within groups for all scaled items. See Wilcoxon, F. Individual comparisons by ranking methods. Biometrics Bull., **1**: 80–82, 1945. For all tests of significance in this study, the .05 level of confidence was used.

TABLE 2

Group Comparisons	Before patient admission	Attitude change during hospitalization
Day Patients and Hospital Patients	T = 55.5*	ns
Day Relatives and Hospital Relatives	T = 46.5*	ns
Day Patients and Day Relatives	ns	ns
Hospital Patients and Hospital Relatives	T = 43.5†	ns

* The day group was more positive than the hospital group in attitudes toward the institution.
† The hospital patients were less positive than the hospital relatives in attitude toward the institution.

four groups. Attitude changes were significant in a negative direction for day relatives (T = 39.5), for hospital patients (T = 0.0), and for hospital relatives (T = 37.0); attitude changes were insignificant for day patients.

Attitudes towards Mental Institutions. With regard to attitudes toward mental institutions, the significance of the various comparisons between the four groups before the patient's admission to the hospital and the amount of attitude change during hospitalization is presented in Table 2.

Before patient admission the scores for all four groups were located towards the positive end of the three point scale; they ranged from 2.1 to 2.6. The scores showing change of attitude during hospitalization were even closer to the positive end of the scale and represent attitude change in a positive direction for each of the four groups; these scores ranged from 2.3 to 2.8.

The significance of these attitude changes toward the mental institution from before admission to six or more months after hospital admission was ascertained for each group. Changes in attitude were significant in a positive direction for the day patients (T = 37.5). Changes in attitude were not significant for the other three groups of day relatives, hospital patients and hospital relatives.

In response to the question, "Do you find any problems in cooperation with hospital requests?", only four patients mentioned problems. No relatives responded concretely to this question.

With regard to the question, "Do you have any suggestions for making the hospital a more effective place?", Table 3 presents a categorization of suggestions, by respondents.

The last questions asked concerning mental institutions were, "Would you rather be treated at a day care center or at a mental hospital? Why would you prefer one rather than the other?" The frequency of preference for day or hospital care, by type of respondent, is presented in Table 4.

Chi Square tests on the frequencies in

TABLE 3

Suggestions for Making the Institution More Effective, by Type of Respondent

Suggestions	Day patients	Day relatives	Hospital patients	Hospital relatives
Enlarge physical plant	7	29	6	14
Enlarge professional staff	2	5	3	8
Enlarge or improve treatment facilities	1	3	0	1
Enlarge or improve subsidiary facilities such as recreation, vocational guidance, food, clothing	0	0	3	4
Eliminate mixing of cases: by age group, by severity of illness	0	0	3	4
Pay more attention to families of patients	0	1	0	1
N	8	32	8	24

TABLE 4

Institutional Preferences, by Type of Respondent

Institutional Preferences	Day patients	Day relatives	Hospital patients	Hospital relatives
Day Care	20	40	14	22
Hospital Care	1	1	4	12
Ambivalent	0	0	1	4
N	21	41	19	38

Table 4 showed a significant difference (Chi Square = 11.8) between the preferences of the relatives of day patients and those of the relatives of hospital patients. The former exhibited greater preference for day care. There were no significant differences between the following comparisons: 1) preferences of day patients and preferences of their relatives; 2) preferences of hospital patients and preferences of their relatives; 3) preferences of day patients and preferences of hospital patients.

Table 5 gives a categorization of the spontaneous reasons offered by these respondents for their preferences.

Ten of the day patients had had previous experience in hospital care; none of the hospital patients had had previous experience in day care. With regard to the reasons given for day preference, there were two aspects of the category "Be with family" that should be explained. On the one hand, to be with the family was considered desirable because the family could give the patient individual care that would help him, and because the patient had been or would be lonely without the family. On the other hand, to be with the family was considered desirable because the patient could help out in the home, even if in a reduced capacity (*N.B.* especially housewives and mothers), and because the family members had missed or would miss him if he were away.

Attitudes towards Mental Illness. In relation to the questions on attitudes toward mental illness, comparisons between the four groups before patient admission and in attitude change during hospitalization in no instance yielded a significant difference.

Before patient admission the scores for all four groups were located towards the undesirable end of the three point scale; means ranged from 1.7 to 2.0. The scores showing change of attitude during hospitalization were closer to the desirable end of the scale and represent desirable attitude change for each of the four groups; these mean scores ranged from 2.3 to 2.5.

TABLE 5

Reasons for Institutional Preferences, by Type of Respondent

Reasons for Institutional Preferences	Day patients	Day relatives	Hospital patients	Hospital relatives
Day Care Preference:				
Superior personnel	3	3	0	0
Superior treatment	3	9	1	1
Be with family	15	32	11	19
Be with friends and in the community	3	4	0	2
Have freedom	3	2	2	0
Dislike and fear of hospital care	6	22	6	10
N	20	40	14	22
Hospital Care Preference:				
Superior personnel	0	0	0	0
Superior treatment	1	1	3	1
Be away from family	0	0	1	2
Be away from community	0	1	0	0
Have restrictions	0	0	1	0
Inadequacy of only day care for severely disturbed persons	0	0	0	6
N	1	1	4	9

The significance of these attitude changes toward mental illness was ascertained. The amount of attitude change during hospitalization was significant in a positive direction for each of the groups studied: for day patients (T = 8.0), for day relatives (T = 0.0), for hospital patients (T = 0.0), and for hospital relatives (T = 0.0).

The attitudes towards mental illness were analyzed further in terms of *types of desirable-undesirable responses.* Table 6 presents the types of desirable-undesirable responses held at the time of the interview by respondent. With regard to the attitudes towards mental illness held before patient admission, most of the respondents reported that they "had never thought about it" before this hospitalization. A few respondents stated that they learned about the nature of mental illness while in college.

TABLE 6

Attitudes toward Mental Illness, by Type of Respondent

Attitudes	Day patients	Day relatives	Hospital patients	Hospital relatives
Question: *How do you feel towards mental illness?**				
1. It is an illness, to be approached as other illnesses.	3	20	2	20
2. It is a sad phenomenon; I feel sorry for those who are mentally ill.	12	16	10	15
3. It is something bad, a punishment for misdeeds.	1	0	2	0
N	16	36	14	35
Question: *What do you feel is the cause of mental illness*†				
1. Social-psychological causes	14	33	8	27
2. Organic causes	4	7	5	8
3. Magical causes	1	1	3	0
N	15	37	13	30
Question: *Do you feel that mental illness is treatable?*‡				
1. Treatable and curable	13	30	7	18
2. Treatable but not always curable	7	12	10	21
3. Not treatable	0	0	2	0
N	20	42	19	39

* In terms of "desirability", Response 1 rates a +3 score, Response 2 rates a +2 score, Response rates a +1 score.

† In terms of "desirability", a combination of Responses 1 and 2 rate a +3 score, Response 1 or Response 2 alone rate either a +2 or a +1 score depending on the cause mentioned, Response 3 rates a +1 score.

‡ In terms of "desirability", Responses 1 and 2 rate either a +3 or a +2 score, depending on the strength of conviction of treatability, Response 3 rates a +1 score.

DISCUSSION

The findings concerning attitude changes offer evidence that, from the patient's point of view, day care is more effective than hospital care in allowing him to sustain adequate interpersonal relationships with his family. There is no evidence, however, that day care is any more effective than hospital care in assisting relatives to maintain adequate interpersonal relationships with the patient. On the one hand, the relative undergoes pressure against "putting the person away" in a mental hospital instead of caring for him at home. This pressure is substantially relieved by day care treatment. On the other hand, however, the relative has the pressure of the difficulties and inconveniences involved in caring for the person in the home. This pressure is only partially relieved by day care treatment.

The results also show a considerable decline in adequacy of interpersonal relationships between the patient and other family members during the progress of the patient's illness. This was felt among hospital patients, hospital relatives and day relatives. Day patients were seemingly not aware of this decline.

With regard to attitudes toward the mental institution, the major difference between the day and the hospital groups was in the original set of expectations. Day patients and their relatives were more willing to accept the opinions of their doctors that they needed this treatment; they delayed less in coming to treatment; and they were more hopeful concerning the outcome of treatment than were hospital patients and their relatives. Experience with the institution produced relatively the same amount of attitude change toward the institution among day patients and their relatives as among hospital patients and their relatives. This change in attitude was significant in a positive direction for day patients, but was not significant for day relatives, hospital patients or hospital relatives.

When offered a choice, the decided preference of patients and relatives from both institution is for day care. The primary reason given for their preference, the pos-

sibility of remaining with family members, indicates that all feel a definite need for maintaining personal contact with each other while the patient is undergoing treatment. The significant differences in preferences between day relatives and hospital relatives also indicate that experience with day care increases acceptance of that method of satisfying such a need. Another substantial reason for the preference of day care treatment is that the day hospital is seen as a less forboding place than the traditional mental hospital, holding fewer unknowns and carrying less stigma for the patient and his family.

With respect to concepts of mental illness, there were no appreciable differences between the day patients and their relatives, and hospital patients and their relatives, in the desirability of their concepts before or after contact with the institutions. Experience with the institutions was followed by significantly more desirable concepts of mental illness for all four groups. Respondents attributed their change in attitudes to institutional contact. Both institutions were able to lessen feelings of guilt about mental illness, to offer more scientific explanations of its occurrence, and to give more encouragement for its control. The concepts of mental illness expressed by persons in this sample showed considerable sympathy for those who were mentally ill and some comprehension of the nature of the illness.

These findings are for the most part encouraging with regard to the day care setting. They do, however, qualify the general statements of other writers to the effect that day care treatment results in better resolutions of family problems than does hospital treatment. Day patients feel better about family relationships. But the family attitudes of day relatives towards their patients are no better over time than those of hospital relatives towards their patients. This points up a real need for clinical assistance to day relatives in order to enable them to help the patients when they leave the hospital in the evening. Because they share the responsibility of the patient with the hospital during this type of treatment, the day relatives are in need of an understanding of the treatment and especially of support in their own efforts. Given adequate clinical staff and physical space, both often lacking in such settings, the day hospital might be able to provide more effective psychiatric assistance for the whole family group than is possible in a traditional hospital setting. The family in most cases lives near the day hospital, so is geographically accessible to it. And the family is positive in attitude to the day care plan at the outset, making it psychologically accessible as well.

The findings of this investigation suggest several areas for further research on day care treatment. The influence of variations among the clinical and social factors which were matched in this study should be investigated. It might be hypothesized, for example, that attitude differentials between individuals from each type of institution vary by *diagnosis* or *age groupings* of the patients. The small size of the sample used in this project did not permit such analysis. Intensive study of interpersonal relationships within the family constellation of psychotic patients should be undertaken, including study of the difficulties involved in attempts to maintain social contact with the patient and study of the roles assigned to and taken by him during the progression of his illness. Finally, since the crucial test of the day hospital's usefulness lies in the clinical results of its therapy, research on these results is urgently needed. The day hospital, in itself an exciting and hopeful new form of treatment, also provides unique opportunities for research on family group processes and problems of rehabilitation of the mentally ill.

REFERENCES

1. Ackerman, N. Interpersonal disturbances in the family. Psychiatry, **17**: 359–368, 1950.
2. Bernard, R., Robbins, L. and Tetzlaff. The

day hospital as an extension of psychiatric treatment. Bull. Menninger Clin., **16:** 50–56, 1952.

3. Cameron, D. E. The day hospital: an experimental form of hospitalization for psychiatric patients. Mod. Hospital, **69:** 60–62, 1947.
4. Cholden, L. The family of the patient. Menninger Quart., **5:** 16–19, 1951.
5. Clausen, J. A. and Yarrow, M., eds. The impact of mental illness on the family. J. Social Issues, **11:** entire issue, 1955.
6. English, O. S. Psychiatry's contribution to family life. Marriage & Fam. Liv., **12:** 3–5, 1950.
7. Josselyn, I. The family as a psychological unit. Social Casewk., **34:** 336–343, 1953.
8. Levinson, S. and Withey, M. Sessions with relatives of mental hospital patients. Ment. Hyg., **39:** 118–125, 1955.
9. Palmer, J. Group discussion as a method of patient orientation in a neuropsychiatric hospital. J. Clin. Psychol., **6:** 369–373, 1950.
10. Wilcoxon, F. Individual comparisons by ranking methods. Biomet. Bull., **1:** 80–82, 1945.

THE SPEECH PATTERNS OF SCHIZOPHRENIC PATIENTS: A METHOD OF ASSESSING RELATIVE DEGREE OF PERSONAL DISORGANIZATION AND SOCIAL ALIENATION[1]

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The speech of man is one aspect of his behavior that distinguishes him from other mammals and primates. It communicates his moods, emotions, his sensory experiences, his memories, his plans, and his assessments of objects around him. It exemplifies man's sustained dependence on and involvement with other human beings throughout his life, for it is a behavioral function that is learned and carried on ordinarily between two or more people instead of alone.

That the verbal behavior of an individual suffering from a mental disorder is relatively distinctive—both in form and in content—has been obvious to those who listen to the conversations of people with personality disorders. The depressed person is laconic, and talks about self-depreciatory and morose topics. The manic person is verbose, and talks extravagantly about achievements and frequent, superficial contacts with people. The hysteric and schizophrenic are quite variable in the duration of their remarks and they too have characteristic thematic and structural features in their speech.

We have attempted to go beyond the clinical observation that there are certain qualitative peculiarities in the verbal behavior of people who have severe personality disorders. We have entertained the hypothesis that, perhaps, the degree of personal and social disorganization of an individual can be quantitatively assessed, at any one time, from the frequency of occurrence of a cluster of speech habits and themata which have pertinence to the individual's subjective experience.

In a psychophysiologic study (3), we obtained some support for this hypothesis in that the frequency of occurrence of certain thematic categories in a patient's speech was significantly correlated ($r = .46$) with a physiologic condition of the patient, namely, the relative percentage of streptococcal colonies cultured from her throat. We inferred that these speech characteristics of this patient indicated the relative intensity of a cluster of psychologic reactions and conflicts leading to more or less masochistic behavior, and we concluded that our method of analyzing and scoring speech patterns enabled us to estimate quantitatively the relative intensity of the patient's psychologic state.

This study of the speech patterns of schizophrenics is part of a program of basic research into verbal communication from the psychiatric point of view. The theoretical constructs upon which our experimental method of personality assessment is based are only in the initial stages of formulation. A discussion of the basic assumptions behind our procedure and a fuller treatment of the inferences we are making will be published separately. In the present study, we directed our attention to the speaking habits of patients with schizophrenic reactions since they show the most readily apparent deviant characteristics in

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their verbal communications. We had some tentative ideas about the form and content of speech which characterize the schizophrenic reaction type, but we were prepared to search for others or modify our weighting of the importance of one such variable over another. In summary, this was an exploratory, longitudinal study having the following aims:

1. To analyze the verbal productions of a group of schizophrenics over a period of time according to certain a priori categories (structural, emotive, and informative) which were believed to have relevance to the schizophrenic pattern of relating to his environment.

2. To test whether the frequency of occurrence of themata in these categories was quantitatively related to the degree of personal disorganization, social alienation, and isolation of the patients.

3. To modify the categories used for analyses and their weighting according to the empirical objective evidence of their value in distinguishing the degree of personal and social disorganization of schizophrenic patients and revalidate.

PROCEDURE

Eight chronic male schizophrenic patients ranging in age from 27 to 41 were used as subjects, five for the experimental sample and three for cross validation. The subjects were picked from the Psychiatric Wards of the Veterans Administration Hospital, Cincinnati, Ohio. During the period they were observed for this study the only medication they received was reserpine for short periods (up to four weeks) and occasional barbiturates. None of these patients received any other type of somatic therapy.

Method of Eliciting Verbal Samples. The subjects were asked by their individual psychiatrists to speak at approximately weekly intervals for three minutes on any topic they chose. The specific instructions they were given, at the time their first verbal sample was obtained, were as follows:

While you are here in the hospital, and getting treatment, there are certain examinations that I will be doing every week. I'd like to explain one of these. I would like for you to pick up this 'telephone' and talk into it for three minutes. It doesn't matter what you say; anything that comes into your mind. The important thing is to say everything that comes into your mind. I will tell you when three minutes are up. You probably wonder where this 'phone' goes to. It goes to a dictating machine so that one of our secretaries can type up what you say. In this way we will have a weekly record which will be kept confidential in your hospital chart. Do you have any questions?

After all the patient's questions about the procedure were answered, the recording session was started. The patient spoke into a telephone, in the presence of his psychiatrist and his speech was recorded on a tape recorder located elsewhere in the building. The psychiatrist was advised not to reply to any questions the patient might ask once the three-minute recording was started. The spoken material was transcribed by a secretary, and the typescripts of these three-minute samples of speech were analyzed according to schemata of categories that will be described later.

The eight patients were given the same instructions each time another verbal sample was sought except that explanatory information given the first time was omitted. The instructions repeated on recording sessions after the first one read essentially: *I would like you to pick up this telephone and talk into it for three minutes. It doesn't matter what you say; anything that comes into your mind. The important thing is to say everything that comes into your mind. I will tell you when three minutes are up.*

For varying reasons, not relevant to this study, these patients remained in the hospital for different lengths of time; so that

a different number of verbal samples were obtained from each patient.

The Criterion for Evaluating Psychosocial Alienation and Disorganization. Two psychiatrists from the Veterans Administration Hospital, Cincinnati, Ohio independently rated each patient on a 10 point scale along three continua: (1) Interpersonal relations; (2) Intrapsychic phenomena (mental status); (3) Personal habit patterns. The ratings were anchored by descriptions of behavior, but as can be seen from the rating scales, Table 1, we could not avoid having the psychiatrists make discriminations between such comparatives as rare, occasional, moderate, frequent, and so forth.

The psychiatrists who were using these rating scales were instructed to give a rating that most accurately typified the patient over a specified span of time. The time span covered a period of six days, including the three days preceding and the two days following the day on which the verbal sample was obtained. The psychiatrists had access to all data charted in the patient's daily record, including interview notes or other material by attending psychiatrists and other physicians, nurses notes and comments by social workers, occupational and recreational therapists. Sometimes, the raters had additional, unrecorded information about the patients, when the patients happened to be in their care.

It is worthwhile mentioning at this point, because it tends to happen in spite of the most careful efforts to avoid the problem, the occurrence of a subtle but important discrepancy in the rating orientation of the two psychiatric judges, discovered only after the results of our first experiment were being discussed and plans for the cross-validation study were being made. One psychiatrist consistently tended to arrive at a rating by determining the average of typical behavior of the patient; whereas, the other psychiatrist tended to give a rating in line with the worst descriptive feature of the patient over the six day time span.

TABLE 1

Psychiatric Rating Scales used to Assess Severity of Psychosocial Disorganization

Ratings	Behavioral Patterns
	A. Interpersonal Relations
10	Out of contact with others, uncommunicative.
8	(a) Belligerent, aggressive, physically destructive. (b) Brief attempts to relate with others, but usually withdrawn, asocial.
6	(a) Hostile, periodically aggressive but not physically attacking others. Acting out of physical aggression controllable by verbal limit-setting of others. (b) Avoidance of relationships with others, but some participation when others initiate relationship.
4	(a) High frequency of aggressive relations with others, but some autonomous control against hurting others. Some "group" acceptance. (b) Avoidance of relationships with others but some self-initiated participation with others.
2	(a) Some mastery of aggressive impulses towards others. (b) Self-initiated participation with others associated with occasional withdrawal and avoidance.
0	Interpersonal relations congenial and constructive and without notable tension and/or anxiety.
	B. Intrapsychic Phenomena (Mental Status)
10	(a) Openly hallucinating and delusional. Almost constant projection. (b) Severe depression interfering with all activities. Severe psychomotor retardation. Marked excitement. Constant motor activity. (c) Thought processes fragmented. Obsessive doubt. (d) Associations entirely irrelevant. Constant blocking.
8	(a) Hallucinations and delusions occasionally and temporarily suppressed. (b) Occasional brief periods of being less depressed or excited. (c) Beginning organization of thought processes although minor stress produces fragmentation. Much doubt persistently verbalized. (d) Associations impoverished but showing some relevance. Flight of ideas.

TABLE 1—*Continued*

Ratings	Behavioral Patterns
6	(a) Occasional verbalization of hallucinatory or delusional material. Ideas of reference. Obsessions, phobias. (b) Moderate depression, despondent. Moderate sustained euphoria. (c) Thought processes organized, but loosely. Constant rationalization. (d) Association organized but circumstantial. Brief associations but little spontaneity.
4	(a) Rare evidence of hallucinations and delusions. Hypochondriasis. (b) Mild constant depressive or euphoric mood. No vegetative signs. (c) Very shallow thought processes. (d) Circumstantiality less marked. Associations brief with some spontaneity.
2	(a) Frequent use of projection or introjection without major break in reality. (b) Occasionally mildly depressed or euphoric although mood generally appropriate. (c) Thought processes somewhat shallow. (d) Associations show only occasional circumstantiality or conciseness. Spontaneity frequent.
0	(a) Rare use of projection or introjection. (b) Mood shows appropriate fluctuation without persistent tone. (c) Thought processes normally variable. (d) Associations spontaneous, relevant and without circumstantiality or conciseness.
	C. Personal Habit Patterns
10	(a) Incontinent of urine and faeces with smearing. Bizarre. (b) Refusal to eat or drink. Tube feeding a necessity. Omniphagic, rapid weight gain or loss. (c) Inability to sleep or awaken. (d) Sexually assaultive. Homosexually assaultive. Open masturbation.
8	(a) Incontinent of urine and faeces. Decorative. (b) Refusal of food and drink with frequency, but tube feeding not required. Gluttinous. Moderate weight gain or loss.

TABLE 1—*Continued*

Ratings	Behavioral Patterns
	(c) Moderate insomnia. Somnolent. A large amount of time in sleep both day and night. (d) Enjoying homosexual activity. Actively soliciting sexually. Masturbating but generally under some concealment.
6	(a) Occasional incontinence. Slovenly. Able to take care of personal appearance only with direct supervision. Meticulous. (b) Refuses to eat with infrequency. Usually anorectic. Constant overeating. Slow weight gain or loss. (c) Sleeping with difficulty. Lethargic. Daytime sleeping interferes to a degree with necessary ward activities. (d) Rare overt homosexual act. Passive participation. Frequent suggestive remarks to opposite sex.
4	(a) No incontinence. Interest in own personal appearance but generally unkempt. Meticulous at times. (b) Anorectic but eats each meal. Some over-eating. (c) Persistent but mild sleep disturbance. (d) Moderate anxiety in sexually provoking situation.
2	(a) Spontaneous interest in own appearance. Some exaggeration of neatness and orderliness. (b) Mild anorexia or increased appetite not present consistently. (c) Occasional mild sleep disturbance. Restlessness. (d) Impulses generally under control but mild discomfort in stressful sexual situation.
0	(a) Personal appearance appropriate. (b) Appetite normal. Weight constant. (c) Sleep pattern normal. (d) Able to participate in activities with both sexes without overt conflict.

We decided that for the cross-validation the two psychiatrists should base their final judgements on the worst feature occurring over the six day time span, not only to improve consensus of the judges, but also to give more weight to maladjustment and

psychopathologic factors, for this was the principal focus in selecting categories of relevance in the analysis of speech patterns.

The subtle difference in the approach of the two psychiatrists to the task of rating the patients will be shown later not to have had much discernible effect on the reliability of quantifying relative degree of emotional sickness within a patient, *i.e.*, intra-individual differences. But it is possible that this difference in approach by the raters was one of the factors resulting in a low correlation between them in rating relative degrees of sickness among patients, *i.e.*, inter-individual differences.

The ratings by the two psychiatrists on each criterion scale were tabulated separately. After reliability coefficients were found, the ratings of the two psychiatrists were combined, and these were arranged, for each patient, in the order from the lowest score (least sick) to the highest score (sickest). These rank orders were then compared to the rank orders obtained by the analysis of the three minute verbal samples.

The Experimental Method of Evaluating Psychosocial Disorganization and Isolation through Analysis of Speech Patterns. In developing this method, one of the investigators (L.A.G.) set down all the thematic and formal characteristics of the verbal activities of schizophrenic patients that he believed might vary in frequency of occurrence with the relative levels of integration and operational perspective of a schizophrenic person. One group of categories chosen covered statements about how the patient perceived the relationships between other people or between others and himself. These categories included avoidance propensities, hostile or adversely critical propensities, and friendly approaching tendencies. One group of categories covered information about the speaker's subjective experiences, such as, orientation or disorientation, disturbances of emotion or functioning within the self, and feelings of improvement or well being. One category covered references to various common conversational topics, such as, the weather, food, sleep, whether good, bad or neutral. Another group of categories covered certain structural aspects of the speech, the form, clarity, and accuracy of the verbal activity, *e.g.*, repetitions of words or phrases, bizarre or unintelligible remarks and obviously fallacious remarks. Still another group of categories referred to the use of various words designating the self or group designations in which the self was included, such as, the words "we" or "us".

Each category was assigned a weighting, plus or minus one, or plus or minus ½. A minus weighting was assigned to the category when the item was considered to indicate personal malfunctioning and/or social alienation. A plus weighting was assigned to an item when it was thought to imply personal and/or social integration and well-being.

Some remarks about the system of scoring a verbal sample are in order here. A category was scored, by a code symbol, each time it occurred in a unit of communication. A communication unit was arbitrarily defined as a clause, *i.e.*, the combination of a subject and predicate, for this seemed to be the smallest unit, except for interjections, that conveyed information about objects, thoughts, feelings, and actions. A list of rules that were followed in scoring the categories is given in Table 4, which also gives the categories, and their weights, as they were revised after the completion of Experiment 1.

An example follows of a three-minute verbal sample actually produced by patient 7; the example illustrates our system of scoring those clauses which have scoreable items, with appropriate symbols designating each category (See Table 4).

Can I ask some questions?/ I want to
IIB 1
know/ how come/ I'm having so many headaches these days./ I went down in O.T.

this morning./ Woman asked me/ 'What's
IIB 1
the matter?'/ I told her/ I just didn't feel
IIB 1 IIB 4
good./ My head was hurting./ I don't
IIB 1
know./ It might come from a lot of worry-
IIB 1
ing./That might be causing, pressing on my
IIB 4 IIB 1
mind./ I don't know./ I'm getting worried
IIF 1
an awful lot./ Didn't sleep too well last
IIB 4 IIIB 1 ID
night/. I don't know./ Doc, *you you*[4] know
2 IIB 4 IA 1
better than/ I do./ I don't have too much
faith, Doc,/ except I want to ask you some
IIIA IIB 4
questions/ (2 words)[4]./ *I don't have too*
IIB 4 IIIB 2
much to say./ I don't know what to say,
IIIA IIB 4
Doc,/ except (2 words)[5]./ *I don't have*
IIIB 2 IIIA
nothing to say./ I been trying—/ I'm be-
IIB 1 IIF 2
ginning that daggone talk in my sleep at
IIIA
night again./ I talk about—/ boy's telling
IIIA
me I's talking about uh/ I don't—/ me and
IIIB 2
my wife *went out,*/ kids *went out,*/ I spent
IIIB 1
certain *amount amount* of money,/ he
IIIA IIB 1
said—/ that's/ what they say./ I talk in
IIF 2 IIIA IIB 1
my sleep./ I didn't—/ that would start
happening back to me again./ I thought/
IIB 1 IIIA
that was all over with./ I guess/ I'm (3
IIB 4
words)/ That's all/ I've got to say now./
IIB 4
It just don't make sense./ Ain't it up yet?/
IIIA
(3 words)[4]./

[4] Underline indicates repetitions.
[5] Unintelligible, inaudible words.

RESULTS: PART 1

The scores on each verbal sample were tabulated and counted, the total minus scores were subtracted from the plus scores, and a raw score obtained. To make allowance for differences in word output per three-minute verbal sample, the raw scores for each sample were divided by the total number of words spoken in the sample and multiplied by 100 to give a corrected score for each verbal sample.

In Part 1 the verbal samples were all scored by one of the investigators and no check of the reliability of scoring was made. In cross-validating, however, a check was made of the reliability of the revised system of scoring. A total of 41 different verbal samples produced by three of the patients were coded independently by two different individuals and a Pearson product moment correlation was obtained between the two sets of scores. The correlation coefficients for the individual patient were .77, .82 and .89 with an overall correlation of .87.

The ratings of the two psychiatrists were correlated to determine the reliability of this method. The product-moment correlations between raters for each subject and for each of the three scales used, as well as for the ratings obtained when the three scales were combined with equal weighting, are shown in Table 3.[6] It can be seen that there was respectable correlation between the scoring of the two raters for the first three subjects, and for the fifth subject (although the total number of time periods he was assessed amounted to only five), but the coefficient was lowest with subject 4. Examination of the standard deviation of ratings on subject 4 reveals, as compared to

[6] The ratings of each psychiatrist on each criterion scale was transposed to a mean of 5 and a standard deviation of 2 on the total sample before combining them into a composite score in order to give equal weighting to each criterion factor. This also resulted in giving equal weight to each psychiatrist's ratings when these were combined together to be used as the criterion for the experimental assessment procedure.

TABLE 2

Pearson Product Moment Correlations Between Raitngs of Two Psychiatrists Made at Various Times on Each of Five Individuals

Patient	No. of Samples	Correlations Between Psychiatrists on Criterion Scales				Composite Scale Mean		Standard Deviation	
		Mental Status	Interpersonal Relations	Personal Habits	Composite Ratings	Psychiatrist		Psychiatrist	
						#1	#2	#1	#2
1	21	.95	.38	.09	.66	8.47	11.57	3.51	3.44
2	20	.42	.65	.24*	.71	9.60	16.88	3.88	3.92
3	15	.88	.89	.68	.94	12.59	13.53	4.09	4.96
4	15	.27	.17	.37	.54	9.91	8.93	1.06	1.57
5	5	.75	Indeterminate	.50	.66	15.58	14.00	3.21	1.10
Total	76	.43	.42	.48	.59				

* Based on only 13 ratings.

those on other subjects, that this patient varied little in his degree of disorganization over 15 periods of observation; he fluctuated within a narrow range. Such a restriction of range in general has the affect of attenuating the correlation between two variables and probably explains the low correlations obtained for this subject.

While the raters showed fairly good agreement on judgements made within individuals they showed practically no agreement as to the relative degree of personal and social disorganization of different individuals, with the exception of ratings on "personal habits". Thus for the composite rating the average correlation within individuals was .80 while between individuals it was only .22. This lack of correlation over individuals tended to lower the reproducibility of ratings over all samples and made it unlikely that we would be able to predict, by means of the verbal analysis data, the inter-individual differences as adjudged by the set of criteria.

The principal criterion to be used for the verbal analysis was the combined composite ratings for each individual. The reliability of these combined ratings were found to range from .80 to .97. These reliabilities (within individuals) were all sufficiently high to warrant their use in validating the scores on the experimental verbal material.

Table 3 presents the rank order correlations obtained for each subject by use of the two methods of assessment. Those correlations marked with an asterisk reach a convincing level of statistical significance. The correlations between the two different methods as applied to subject 5 appear to be high, but because only five periods were assessed with this subject, only the correlation with mental status is high enough to satisfy a 5 per cent level of confidence. The correlations are high enough, however, to encourage belief that in this subject, as well as the first three subjects, the method of analysis of speech patterns to assess severity of schizophrenic illness is valid. None of the correlations for subject 4 reach a satisfying level of statistical significance, but this is not surprising since as previously discussed the spread of criterion ratings and their reliability for this subject was low.

The overall results give strong support to the theory that counting the frequency of occurrence of certain typical features in the verbal communications of a schizophrenic person provides a quantitative estimate of the relative severity of his disorder from one time to another. The experimental

TABLE 3

Spearman Rank Order Correlations of Verbal Analysis Scores with Combined Psychiatric Ratings for Each of Five Individuals

Patient	No. of Samples	Rank Order Correlations with Criterion Scales			
		Mental Status	Inter-personal Relations	Personal Habits	Com-posite Scale
1	21	.85‡	.29	.41*	.62†
2	18	.80‡	.76‡	.66†	.81‡
3	15	.71†	.64†	.67†	.70†
4	15	.35	.30	.30	.35
5	5	.98*	.45	.66	.80

* Significant at .05 level
† Significant at .01 level
‡ Significant at .001 level
} one-tailed hypothesis.

method of assessing severity of schizophrenic disorder, from time to time within an individual, correlated well with the standard method of evaluation. However, the results, though very encouraging from the viewpoint of the experimental method's giving valid results in distinguishing changes within a patient, did not appear to give very satisfactory results towards comparing the severity of disorder between different schizophrenic patients.

We next sought to improve the validity of our experimental method by doing an item analysis. The verbal samples were divided into three groups according to whether they were obtained during periods when the two psychiatrists rated the patients as being most, moderately or least disorganized and alienated. A careful check was then made to determine which items in the verbal samples tended to differentiate these three groups. Items which were found not to have any notable bearing on relative personality disorganization or organization were eliminated. For instance, the categories covering words referring to the self or references to group belongingness ("we, us, our") were not found to be of discriminatory importance in this study, although in a previous study (1) the relative percentages of such references were found to distinguish a group of psychotic inpatients from a group of non-hospitalized, well-functioning individuals. Also, it was found possible to combine several categories because they were of about equal validity and required no differential weighting. And finally, we found that, in several instances, our a priori weighted scores attached to each category were not accurate. In most instances we merely had to change a score from a number (-1) indicating features highly characteristic of schizophrenic disorder to less characteristic features ($-\frac{1}{2}$) or vice versa. In rare instances, we had to reverse our weighting completely, that is from a negative score (indicative of sick behavior) to a positive score (indicative of well behavior). An example of such a reversal was the category of references to weather, as bad, unpleasant, dangerous. Our tentative assumption had been that such references by a schizophrenic reflected his inner turmoil and despair of satisfying object relations (and that this should be weighted on the minus side) and that references to good, pleasant weather reflected a more satisfying relationship with external reality (and thus should be weighted on the plus side). In our sample of subjects under the experimental conditions, we found that any references by the patient to bad weather, as well as good weather, were probably more indicative of sociableness and readiness to follow cultural convention than of withdrawal and despair. Frequent repetitions within a three-minute time span of talk about poor weather still appeared to represent foreboding preoccupation with poor inter-personal relationships. So, until we obtained more evidence to lead us to another opinion, we decided to score the first two references per three-minute verbal sample as positive, and any references thereafter within this category as negative.

The revised system of coding and tallying peculiar and healthy aspects of the speech patterns of schizophrenic patients is given in detail in Table 4.

TABLE 4

Verbal Analysis System for Rating Severity of Schizophrenic Disorganization

Score	Categories
	I. Interpersonal references, including fauna and flora
	A. To thoughts, feelings or reported actions of avoidance, leaving, deserting, spurning, understanding of others
−1	1. self avoiding others
−1	2. others avoiding self
	B. To unfriendly hostile, destructive thoughts, feelings or actions
−1	1. self unfriendly to others
−1	2. others unfriendly to self
	C. To congenial and constructive thoughts, feelings or actions
+1	1. others helping, being friendly towards others
+1	2. self helping, being friendly towards others
+1	3. others helping, being friendly towards self
	D. To others including fauna, flora, things
−1	1. bad, dangerous, low value or worth, strange, ill, malfunctioning
+½	2. intact, satisfied, healthy, well
	II. Intrapersonal references
	A. To disorientation—orientation, past, present or future. (Do not include all references to time, place, or person, but only those in which it is reasonably clear the subject is trying to orient himself or is expressing disorientation with respect to these. Also, do not score more than one item per clause under this category.)
−1	1. indicating disorientation for time, place, person or other distortion of reality
+½	2. indicating orientation in time, place, person
−½	3. indicating attempts to identify time, place or person without clearly revealing orientation or disorientation
	B. To self
−1	1. injured, ailing, deprived, malfunctioning, getting worse, bad, dangerous, low value or worth, strange
+½	2. getting better
+1	3. intact, satisfied, healthy, well
−½	4. not being prepared or able to produce, perform, act, not knowing, not sure
−1	5. to being controlled, feeling controlled, wanting control, asking for control or permission, being obliged or having to do, think, or experience something
−½	C. Denial of feelings, attitudes, or mental state of the self
	D. To food
−1	1. bad, dangerous, unpleasant, or otherwise negative; interferences or delays in eating; too much and wish to have less; too little and wish to have more
+½	2. good or neutral
	E. To weather
+½*	1. bad, dangerous, unpleasant, or otherwise negative (not sunny, not clear, uncomfortable, etc.)
+1	2. good, pleasant or neutral
	F. To sleep
−1	1. bad, dangerous, unpleasant, or otherwise negative; too much; too little
+½	2. good, pleasant or neutral
	III. Miscellaneous
−1	A. Remarks or words that are not understandable or are vague or bizarre (in the opinion of the coder); incompleted sentences, clauses, phrases (blocking) obviously erroneous or fallacious remarks or conclusions
	B. Repetition of ideas in sequence
−½	1. words separated only by a word or phrase, (excluding instances, due to grammatical and syntactical convention, where words are repeated, e.g., "as far as, by and by," and so forth. Also, excluding instances where such words as "I" and "the" are separated by a word.)
−1	2. phrases, clauses (separated only by a phrase or clause)

* Scored +½ for the first two in a verbal sample and thereafter this item is scored −1.

Rules for Scoring the Categories

1. The unit of verbal communication will be the grammatical clause, *i.e.*, one subject and one predicate or instances where one of these elements is left out but understood. As many different items may be tallied per clause as apply, except where noted below.

2. References to the categories are to be scored regardless of the grammatical tense in which they are expressed. That is, a category is to be tallied whether expressed in the past, present or future tense or whether expressed as a conditional or as a wish or hope.

The only exceptions to this rule are categories IIB 2 and IIB 3, *i.e.*, "getting better" and "feeling well" in the instance of these categories do not score these items when in a conditional sense or in the form of a wish.

TABLE 4—*Continued*

3. Use literal more than inferential criteria when deciding whether or not to tally a category. This means that the principal criteria as to whether or not a category is to be scored depends on what the subject actually says in a clause and not so much on what the scorer tends to infer. If a repeated idea is inferable in a series of clauses but is not definitely restated, the item is not to be rescored.

4. Except where otherwise noted, several different categories may be tallied per clause. Avoid, however, inconsistent over scoring. For example, if a clause is tallied as not being understandable or vague or bizarre (category IIIA) it is not generally likely to be scoreable also in a category that requires the communication of some definite bits of information. It is recognized, however, that there are exceptions to this point.

5. Where a series of content references are made in a sentence, the category is to be scored only once instead of the total number of references. For example, when the subject lists the food items he ate for a meal in a series fashion, the food category (IID) is to be tallied only once.

6. References that fall into any one of the designated categories, but involve infra-human animals or inanimate objects instead of human beings, may be nevertheless scored the same as if they were about human animals.

The verbal samples were recoded in terms of this revision. The new scores obtained were then compared to the combined ratings of the two psychiatrists. Table 5 shows that with these revisions better rank-order correlations between the standard method of assessment (criterion) and the experimental (revised) method were obtained for all subjects. The rank-order correlation over individuals did not differ significantly from zero.

That the separate groups of categories of the verbal behavior method of assessment (after revision) were all contributing to the correlation with the composite psychiatric ratings is indicated in Table 6. Each group of categories is significant for at least one of the five patients. However, no group of categories yielded the highest correlation consistently for all individuals. Thus while it appears that the categories we were using are appropriate in differentiating schizophrenic speech, a particular individual tends to show only some of these manifestations to any great extent.

TABLE 5

Correlations of Ratings of Verbal Samples with Combined Psychiatric Ratings after Revising the Scoring of the Verbal Samples on the Basis of an Item Analysis

Patient	No. of Samples	Rank Order Correlation with Criterion Scales			
		Mental Status	Interpersonal Relations	Personal Habits	Composite Scale
1	21	.86‡	.36	.51†	.71‡
2	18	.87‡	.77‡	.84‡	.88‡
3	15	.80‡	.75‡	.75‡	.77‡
4	15	.33	.54*	.56*	.67†
5	5	.88	.65	.77	.90*

* Significant at .05 level
† Significant at .01 level
‡ Significant at .001 level
} one-tailed hypothesis.

TABLE 6

Rank Order Correlations of Major Categories of Verbal Analysis with Composite Psychiatric Ratings after Rescoring

Patient	Major Categories of Verbal Analysis after Revision				
	Interpersonal	Orientation	Self	References to Food, Sleep, Weather	Blocking, Repetition, Bizarre Remarks
1	.23	.60†	.67†	.37*	.38*
2	.64†	−.08	.42*	.65†	.56†
3	.20	.10	.74†	did not occur	.42
4	−.21	.21	.42	.11	.62†
5	.88	.80	.70	.72	.80

* Significant at .05 level
† Significant at .01 level
} one-tailed hypothesis

RESULTS: PART 2—CROSS-VALIDATION

Three new patients served as subjects for the cross-validation study. The same two psychiatrists assessed the severity of the patient's disorder as described in Part 1 (Table 1). This time, however, the different bias of these raters in evaluating the first five patients was corrected, and each rater made his judgements on the same basis, that is, they now tended to give a score on each scale that was in line with the sickest mani-

TABLE 7

Product Moment Correlations Between Ratings of Patients (6, 7, and 8) by the Two Psychiatrists

Patient	No. of Samples	Correlations Between Psychiatrists on Criterion Scales				Composite Scale Mean		Standard Deviation	
		Mental Status	Interpersonal Relations	Personal Habits	Composite Scale	Psychiatrist		Psychiatrist	
						#1	#2	#1	#2
6	11	.77	.42	.11	.58	6.45	6.77	0.92	1.56
7	15	.88	.45	.32	.73	5.66	5.37	1.48	1.02
8	14	.96	.96	.35	.98	7.72	8.36	4.01	4.64
Total	40	.94	.91	.33	.93				

festations occurring during the six day period of observation instead of trying to arrive at an approximate average.

The three-minute verbal samples of each subject were assessed this time according to the revised schemata of the experimental method (Table 4). Table 7 indicates that the over-all correlation between the ratings of patients 6, 7, and 8 by the two psychiatrists was .93 and that the highest concordance between the two psychiatrists was reached on the rating scales of mental status (.94) and interpersonal relations (.91).

Table 8 shows that significant correlations were obtained between the verbal analysis scores (revised system) on patients 6, 7, and 8 and the criterion ratings. The highest correlation (.80) occurred with patient 8. A glance at Table 7 shows that the mean ratings by the psychiatrists on this patient were the highest *i.e.*, this patient was the sickest, and the variability of this particular patient was far greater than either of the other two patients. With the first five patients we also found that the experimental method of assessment was more highly correlated with the criterion when a patient showed a relatively wide range of variability from time to time in the characteristics being measured.

A further investigation was made to determine to what extent our positively and negatively weighted items in the verbal samples separately accounted for the significant correlations obtained. For each patient in this experiment, it was found that both types of items correlated with the composite-criterion ratings, the negative scores showing the higher correlations. But in every case the sum of the positive and negative scores yielded a higher correlation than either type of score alone. These findings support the assumption that positive and negative indicators may be added to give a more accurate estimate of the level of functioning of an individual.

TABLE 8

Correlations of Verbal Analysis Scores (Revised System) with Combined Clinical Psychiatric Ratings

Patient	No. of Samples	Rank Order Correlations with Criterion Scales			
		Mental Status	Interpersonal Relations	Personal Habits	Total
6	11	.61*	.64*	.25	.58*
7	15	.25	.62†	−.04	.44*
8	14	.40	.81‡	.73†	.80‡

* Significant at .05 level
† Significant at .01 level
‡ Significant at .001 level
} one-tailed hypothesis.

DISCUSSION AND CONCLUSION

In terms of the criterion used, the counting and scoring of certain speech patterns of the schizophrenic patient constitute a valid method of providing a quantitative estimate of intra-individual variations in the degree of schizophrenic disturbance. But our ver-

bal analysis method does not provide satisfactory information about inter-individual differences in degree of schizophrenic disturbance for the eight patients we have examined. One possible explanation of this finding is that our total sample is too small to give us adequate information on inter-individual differences. It is likely that item weightings could be found which would enable such differentiation to be made, but with only five individuals available for item analysis it was not possible to determine adequate weighting of items for this purpose. A study of single verbal samples obtained from a group of 30 to 50 schizophrenic patients, in which we compared scores on these samples to the same composite criterion we have used in the experiments reported here, would give us a better idea of the item weightings necessary to obtain differentiations among individuals. We intend to undertake this type of investigation.

On the other hand, it is possible that the kind of verbal items we have chosen to examine are especially relevant to changes within an individual, but even with modified weightings such items are not the kinds that distinguish one schizophrenic patient from another; there may be verbal items we have not focused upon that might be of more discriminatory value in comparing one schizophrenic to another. Furthermore, variations in frequency of occurrence of themata or mannerisms in speaking may be more closely related to variations in intrapsychic pressures than to inter-individual differences. These possibilities should be investigated. We are personally inclined to the opinion that a reliable and valid quantitative method of speech analysis can be developed that will differentiate inter-individual as well as intra-individual variations.

The advantages of our experimental method in estimating variations in the degree of schizophrenic disorder within an individual are several fold.

1. It is a procedure that is simple and rapid to administer and the verbal samples can be scored with reliability.

2. It involves one modality of human functioning *i.e.*, speech, instead of a complex cluster of many functions, such as was involved in the clinical psychiatric ratings (intra-psychic data, inter-personal data, personal habit data) and yet, within one individual verbal behavior analysis appears to provide a valid measure of a conglomerate of functions.

3. There are no other standardized psychologic sampling or testing procedures that provide a satisfactory means of estimating variations, over many observational periods, of the degree of schizophrenic disorder.

The present limitations of our experimental method include the following:

1. There is no substantiating evidence, as yet, that the procedure gives information enabling one schizophrenic individual to be compared to another in terms of degree of social alienation and personal disorganization.

2. Some schizophrenic patients are not only disinterested in talking but will not talk. Obviously, patients who refuse to talk cannot be properly assessed by speech pattern analysis. We are engaged in studying and learning more about the descriptive and psychodynamic features of those patients who are speechless when asked to have their speech recorded.

We have found that a small variety of psychotic patients, who otherwise may do some talking, are mute when asked to talk under the conditions we used in eliciting speech from patients in the study we have just reported.

3. Patients may develop symptoms due to other factors than their schizophrenic disorder. For example, a schizophrenic patient may complain of the side effects of some medication he has received, and if no allowance is made for this the patient may not get credit, by our system of scoring, for

discriminating one physiologic state from another. Instead, he will be scored as being sicker for referring to some personal malfunctioning. As a matter of fact this issue occurred when one patient, presumably, receiving a small amount of reserpine, complained a few times of nasal stuffiness while giving a three minute verbal sample. The scorers of the three minute verbal samples of speech, not having access to any other information about the patients except the three minute verbal samples, had to score these references IIB 1, self, malfunctioning, which coding gave a weighting for illness and no weighting for discriminatory capacity. Difficulties such as these may have had a particularly adverse effect on interindividual comparisons. This limitation of our assessment procedure is not, in our opinion, a serious one, and an adjustment for such factors could easily be made.

We have the impression that certain aspects of the method we used in eliciting speech from our schizophrenic subjects were stressful to the point of inhibiting verbal communication in some patients who might, otherwise, have spoken. The use of a telephone to talk into, for example, may have provoked unnecessary suspicion or confusion in patients already suspicious or confused. Talking into a telephone is customarily associated with being talked to and the occurrence of auditory hallucinations while talking into the telephone may have been facilitated by this feature of our procedure. A simple microphone in full view (or even a hidden one) may have been less threatening or confusing. Also, the fact that our patients were told that what they said was going to be recorded on a dictating machine and that what they said was going to be made part of their confidential hospital chart was unnecessarily stressful. In subsequent studies, we are returning to the use of conditions and instructions to elicit verbal behavior that we have previously tried, and which appear to be less anxiety producing (1, 2). The fact that, in spite of the rather adverse features of our method of eliciting speech from our schizophrenic patients, we could demonstrate that verbal behavior analysis provided a quantitative means of assessing the relative degree of personal and social disorganization of an individual, at any one time, supports our viewpoint that speech pattern analysis is a highly fruitful approach towards the assessment of personality variables.

We think that some method of assessment of degree of mental sickness smilar to the one we used in the experiments we have just described could be adapted for use in studies attempting to evaluate the effects of pharmacologic agents in personality disorders. In the Department of Psychiatry, Cincinnati General Hospital, two separate pilot studies are in progress to test the applicability of the analysis of verbal behavior to such clinical research problems as the action of certain "tranquilizing" drugs.

SUMMARY

1. This is a report of a study exploring the usefulness of expressive speech patterns as a means of assessing the relative degree of personal disorganization and social alienation in schizophrenic patients.

2. Using five male chronic schizophrenic patients, an index of the relative degree of personal disorganization and social alienation of a patient at different times was obtained from approximately weekly three-minute verbal samples, elicited with standardized instructions. The scores on the speech samples were obtained by (a) counting the frequency of occurrence of various content and form categories within units of verbal communication (the grammatical clause), (b) weighting each categorical reference minus or plus one (or some fraction of one) depending respectively on whether the references were considered to indicate more or less schizophrenic disorder, (c) and adding the plus and minus scores and dividing the sum by the total number of words spoken per verbal sample (times 100)

to give a numerical index of degree of schizophrenic disorder manifested per 100 spoken words. From five to 21 indices were obtained on each patient on different occasions, indices being obtained on a total of 76 verbal samples in this experiment. The criterion to which these indices were compared was the consensus of the ratings by two independent judges (psychiatrists) who rated the patients over six day periods on three separate scales: intrapersonal phenomena (mental status), interpersonal-behavior, and personal habits. The rank-order correlations between the estimates obtained from the verbal analysis method and the composite criterion, on these five patients ranged from .35 to .81. The lowest correlation occurred with the individual whom the psychiatrists found to show the least variation in behavior. When an item analysis was done, various categories were found to be more relevant to the desired predictions than others; also, some of the plus or minus weightings were observed to be inaccurate. Accordingly, a revision was made of the system of scoring the verbal samples. When the revised scores on the five patients were compared to the criterion, the correlations had all been increased (.67 to .90) and were all significant beyond the .05 level. Thus the verbal analysis method of assessment showed relatively high validity, as compared to the criterion, in assessing intra-individual variations in degree of personal disorganization and social alienation.

3. A cross-validation was made of the revised schemata of scoring the three-minute verbal samples. Forty verbal samples produced by three different male schizophrenic patients were analyzed according to the revised method and compared to the ratings obtained by the criterion. All three rank-order correlations were statistically significant by a one-tail hypothesis (.44, .58, .80) despite the fact that two of the three individuals showed a relatively narrow range of variation in behavior as judged by the psychiatrists' ratings. The revised scoring of verbal samples was valid for intra-individual but not for inter-individual variations.

The value of analysis of speech patterns of schizophrenics to assess intra-individual variations in degree of personal disorganization and social alienation was demonstrated. Further study and revisions of procedure must ensue before inter-individual variations can be accurately estimated through analysis of speech patterns.

4. A discussion of certain practical and theoretical aspects of these findings is included.

REFERENCES

1. Gottschalk, L. A., Gleser, Goldine C. and Hambidge, G. Jr. Verbal behavior analysis: some content and form variables in speech relevant to personality adjustment. Arch. Neurol. and Psychiat., **77**: 300-311, 1957.
2. Gottschalk, L. A. and Hambidge, G. Jr. Verbal behavior analysis: a systematic approach to the problem of quantifying psychologic process. J. Projective Techn., **19**: 387–409, 1955.
3. Gottschalk, L. A. and Kaplan, S. Towards a quantitative method of estimating the variations in the intensity of a psychologic conflict or state. Arch. Neurol. and Psychiat., **79**: 688-696, 1958.

INFLUENCE OF CHLORPROMAZINE ON CERTAIN BIOCHEMICAL VARIABLES OF CHRONIC MALE SCHIZOPHRENICS[1]

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The widespread use of chlorpromazine makes imperative an increased knowledge of its biochemical effects, especially during its prolonged administration and subsequent withdrawl. Accordingly, chronic male schizophrenics who were receiving clinically effective doses of chlorpromazine were divided into groups based on continued administration or withdrawal from the drug. These were subjected to concurrent biochemical, psychiatric and psychological study in a collaborative endeavor between the Waco Veterans Administration Hospital and the Clayton Foundation Biochemical Institute of The University of Texas. Details of the psychological study have been presented elsewhere (12).

EXPERIMENTAL

Chronic male schizophrenic patients 22 to 50 years of age from two main buildings at the Waco Veterans Administration Hospital were used. The patients had been hospitalized continuously for from two months to several years. Chlorpromazine dosage was established clinically (200 to 800 mg/day with 86 per cent of the patients receiving 400 mg/day). The patients had been on continuous maintenance doses of chlorpromazine long enough to have stabilized to its action, and all had shown some improvement during treatment.

The patients were stratified into seven blocks or levels based on previous lengths of chlorpromazine therapy and the 16 men in each block were divided randomly into four groups designated as TT, TP, PT, and PP, respectively according to the particular pattern of chlorpromazine (Thorazine) or placebo therapy. For an initial three month period the TT and TP groups both continued to receive chlorpromazine tablets (Thorazine[4]), while the PT and PP groups received lactose placebo tablets identical in appearance to the chlorpromazine tablets. During this period psychological testing and behavioral ratings were made on each patient. Special precautions were taken to prevent ward and research personnel from knowing the identity of the groups.

At the start of the chemical testing phase (second three month period) placebo tablets were substituted for chlorpromazine in the TP group, and the reverse was done with the PT group. The TT and PP groups continued to receive chlorpromazine and placebo, respectively, throughout the experimental period. The experimental design

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[4] Thorazine and placebo tablets (lactose), identical in appearance, generously were provided by Smith, Kline, and French Laboratories, Philadelphia, Pa.

TABLE 1

Experimental Design and Explanation of Terms Used

Seven-by-four factorial (randomized-block) design, with four within-cells replications to provide estimates of error variance, and seven different levels (blocks) of previous chlorpromazine therapy and four experimental groups (double-blind administration).

Pre-Test Period	Test Period				
	Phase 1 (Randomized into groups from each level, balanced across wards and buildings)	Phase 2 (Drug regimen changed)			Subjects' age (years)*
Weeks	0	12	18	24	
Trials		1	2	3	
Thorazine therapy (all men) 112 chronic male schizophrenics, stratified into 7 levels (16 men each) based on length of previous thorazine therapy.	Thorazine (T) N = 56	Thorazine-Thorazine (TT) N = 28			35.0
		Thorazine-Placebo (TP) N = 28			35.8
	Placebo (P) N = 56	Placebo-Thorazine (PT) N = 28			38.3
		Placebo-Placebo (PP) N = 28			37.4 S. D. = 6.5
Test Protocol	Behavioral Psychological	Behavioral Psychological Biochemical			

Statistical Details and Method of Presentation of Data

Group means only are presented, and since the variances were homogeneous throughout, an estimate of the standard deviation (average) for all groups is obtained from the square root of the *Mean Square within cells* (MS_w):

$MS_w = MS_{e1} + (a - 1)(MS_{e2})(1/a)$, where a is the number of trails, MS_{e1} is the *Residual Mean Square between subjects* and MS_{e2} is the *Mean Square pooled subjects* × *trials interaction*.

Only significant "F" ratios will be presented, and where these are significant the differences between individual means may be tested by suitable "t" tests, i.e., different error terms are used to test the significance of differences between the independent items, *Mean Square between groups*, (bg), *viz.*, MS_{e1}, and to test those between the related items, *Mean Square between trials*, (bt) where repeated measures are made on the same individuals, and of the *Mean Square trials* × *groups interaction* (t × g), viz., MS_{e2}. Since the number of subjects in each group is the same (28), *critical differences* (c.d.) may be used in lieu of separate "t" tests. Where the difference between two individual means equals or exceeds the c.d., the means differ significantly ($p = 0.05$). Group means were averaged in most cases where the Fbg was not significant.

$$\textit{c.d. between therapy groups} \quad (\text{c.d.bg}) = t_{.05}\sqrt{(MS_{e1})(2/na)}$$

$$\textit{c.d. between trials} \quad (\text{c.d.bt}) = t_{.05}\sqrt{(MS_{e2})(2/N)}$$

Where a is the number of trials; $t_{.05}$ is the "t" score at $p = .05$ for the degrees of freedom of the error term, n is the number in a group (28), N is the total number of subjects (112). Degrees of freedom of MS_{e1} is 108, MS_{e2} for 3 trials is 216, and for 2 trials is 108.

and explanation of terminology used is presented in Table 1.

Ward behavior was evaluated by use of the Multi-dimensional Scale for Rating Psychiatric Patients (MSRPP) (18), and thought processes were measured by group-administered psychological tests. The two parts of the MSRPP psychiatric-interview rating, and ward-nursing-personnel rating, consist of 40 and 22 independent items, respectively. Ward attendants and nurses were trained to administer the latter, and

the independent ratings by the nurse and the attendant were averaged after inter-rater agreement had been established (12).

The large number of patients and the limited number of clinical psychologists available necessitated group methods of administration of psychological tests. Accordingly, only a limited number and variety of psychological tests of mental ability and perceptual functions were used. These were: the Army Beta, a nonverbal intelligence test (6); the Bender Gestalt, a test of perceptual-motor functioning in the drawing of geometric designs (20); and the Draw-A-Person tests (scored for intellectual level only) (13).

The chemical study started at the midpoint (three months), and included examination of urinary constituents at six-week intervals (three repeated measures or trials on the same patients), and early morning serum constituents during the last two phases. Four consecutive overnight urine specimens from each patient (collected over known time intervals) were pooled. Standard chemical methods were employed for the determination of the following constituents: urinary sodium and potassium (4), calcium and magnesium (5, 23), phosphate (10), urea (25), uric acid (15), creatinine (7), creatine (9), histidine (19), and other amino acids, 17-hydroxycorticosteroids (24), several phenolic acids (1, 26), and serum sodium and potassium (4), copper (11, 22), inorganic and protein-bound iodine (14), and cholesterol (21).

The data were processed for analysis of variance (17), with an IBM Card Program Computer. The distributions of all variables were reasonably normal, the variances were relatively homogeneous, and the best linear estimates were substituted for the few cases of missing data (with an appropriate reduction in the degrees of freedom). Appropriate "t" tests were used to test the significance of individual group and/or trial differences when the appropriate "F" ratios between groups, or trials, or of the interaction of groups × trials were significant ($p \leq 0.05$). Statistical details are outlined in Table 1. Since there were no significant differences between the seven blocks or levels, this distinction was discarded in the analysis.

RESULTS AND DISCUSSION

SELECTION OF CHEMICAL VARIABLES. Criteria used for the selection of chemical variables to be determined included: (1) indices of stress—sodium/potassium, uric acid/creatinine, steroids, and creatine; (2) substances related to energy yielding reactions, activity, and food intake—protein-bound iodine, iodine, phosphate, urea, and creatinine; (3) substances known to be related to nerve and mental function—phenolic acids, amino acids, copper and magnesium (also calcium and phosphate since their metabolism is intimately related to that of magnesium). This chemical spectrum, though far from adequate, permitted some evaluation of factors (*e.g.* environmental changes, endocrine changes, etc.) that otherwise would have been impossible.

RELIABILITY STUDIES. Intraclass correlations from each analysis of variance were computed as indices of "test-retest" reliability over the six-week periods between collection of specimens (17). All coefficients were significantly different from zero ($p < 0.01$) for all variables (including the psychological ones) except serum sodium; *i.e.*, the intraindividual variation between trials was much less than the intraindividual variation within groups. This indicates that the 112 individuals, in general, reacted across time in a characteristic and reliable fashion as measured both by psychological and chemical variables.

ENVIRONMENTAL CHANGES AND POSSIBLE INFLUENCE ON RESULTS. Longitudinal clinical studies are acutely sensitive to environmental and dietary changes. The wards were not air-conditioned, so daily weather data were important (Table 2). Average daily temperature alone is not a sufficient

TABLE 2

Influence of Chlorpromazine on Chronic Schizophrenic Males, General Variables

Variable	Therapy Group	Weeks			Statistical Details			
		12	18	24	$\sqrt{MS_w}$	MS_{e1}	MS_{e2}	Significant "F" ratios
Body Weight (Kg.)	PP	69.5	68.0	64.1	5.59	54.9	19.3	bg – 3.81
c.d.: bg = 7.2; bt = 1.2	TP	75.2	74.5	74.3				bt – 3.24
	PT	76.1	75.8	76.7				t × g – 4.04
	TT	78.5	78.6	79.4				
Urine Flow Rate (ml/hr)	PP	56.8	50.1	53.0	29.6	2134	250	bg – 3.06
c.d.: bg = 14.1; bt = 4.2	TP	56.9	45.2	42.6				bt – 13.9
	PT	71.7	65.3	55.5				
	TT	70.0	65.4	62.3				

Environmental Conditions	Dates of Urine Collections		
	May 24–27	June 21–24	July 26–29
Temperature, °F			
Average	81	87	87
Range	68–93	72–99	74–100
Wind, SSW to SSE			
Average m.p.h.	16	19	13
Relative Humidity			
12:01 p.m.	45	44	38
Barometric Pressure			
(Inches) 12:01 p.m.	29.44	29.40	29.52

* Official Weather Bureau Reports for Waco, Texas.

criterion of environmental conditions, since both wind and humidity also exercise marked influence (8). During the first test period the temperature and humidity were relatively low, and except for a few hours in the afternoon they were in the comfort zone. By the second trial, however, the average daily temperature had increased 8°F. while the humidity remained unchanged. An increased average wind speed helped alleviate the situation, but daily the temperature was rising to almost 100°F. Although the temperature was only slightly higher, and the average humidity was considerably lower during the last trial than it was in the second, average wind speeds dropped. The net effect was more hours of uncomfortable heat.

Undoubtedly the patients had acclimated somewhat to the heat by the last trial. Indicative of adaptive changes (3), the urine flow rates steadily decreased, and the trends in most urinary variables changed sharply between trials 2 and 3, reaching a plateau or returning to the level of trial 1. Furthermore, the urinary sodium/potassium ratios increased, phosphate returned to the levels of trial 1, serum potassium decreased in all except the TP group (but only in this group did sodium increase). Magnesium excretion was elevated in trials 2 and 3 which is in line with the lowered serum levels observed by Bass, *et al.*, (3) during heat exposure. The elevated urea excretion, however, argues against adaptation.

PSYCHOLOGICAL AND PSYCHIATRIC RATINGS. In the initial three month period, no significant differences in behavior or mental function were evident (12), but during the last three months the PP group deteriorated (Table 3). Trends of both the PP and TP groups on the psychological tests were in this direction, but only the results of the

TABLE 3

Influence of Chlorpromazine on Chronic Schizophrenic Males, Behavioral and Psychological Variables[1]

Variable	Therapy Group	Weeks			Statistical Details			
		12	18	24	$\sqrt{MS_w}$	MS_{e1}	MS_{e2}	Significant "F" ratios
Behavioral Ratings (c.d.: bg = 5; bt = 2)								
MSRPP[2]	PP	18	21	21	10.7	281	31.3	t × g − 2.30
	TP	19	19	15				
	PT	17	16	15				
	TT	19	17	15				
Psychological Tests								
Army Beta[3]	Mean	40.8	—	42.5	28.0	1470	99.2	None
Bender Gestalt	Mean	65.7	—	65.1	35.0	2152	298	None
Draw-A-Man[3]	Mean	17.0	—	17.3	10.6	204	22.7	None
Draw-A-Woman[3]	Mean	15.5	—	16.1	11.0	213	30.5	None

[1] Reproduced with the permission of the authors (12).
[2] A low score signifies improved behavior. Paranoid projection (Factor C) and perceptual distortion (Factor F) of the MSRPP of the PP group showed significant deterioration during the final weeks.
[3] Low scores indicate poor mental ability or perceptual function.

behavior ratings (MSRPP) were statistically significant. Scores of factors C (paranoid projection), D (activity level), and F (perceptual distortion) of the MSRPP were analyzed separately, and the therapy group × trial interactions for both C and F were significant. The results of the psychological tests indicated that, in general, intellectual functioning deteriorated only slightly following the removal of chlorpromazine for several months (12).

GENERAL VARIABLES. Body weight showed the most clear-cut group and trend differences of any variable examined (Table 2). The group receiving chlorpromazine continuously (TT) gained steadily throughout the period, while the PT group maintained their weight. The TP group lost weight steadily at a relatively low rate, but the PP group suffered a considerable and steady average weight loss. These weight changes presumably were largely reflective of differences in food consumption, which in turn may be related to the condition of brain mechanisms which regulate appetite. Records of individual food consumption were not obtained.

The urine and serum data from each individual were analyzed in terms of their respective metabolic body weights (16) as metabolic reference standards (8) as well as in the uncorrected form. This correction for body weight did not change the character of the results, however, so the data are presented in their simpler form.

During the second three month period when biochemical data were obtained, the chlorpromazine groups (TT, PT) had higher average urine flow rates than did those on placebos (PP, TP). The men in the TT and PT groups excreted more urea and half again as much sodium as did those in the placebo groups (Table 4). These facts are consistent with the elevated urine flow rate and probably with an elevated food and water intake. Any of these may cause or influence indirectly alterations in nerve physiology. The flow rate decreased steadily in all groups.

URINARY VARIABLES. Most of the urinary variables (except several amino and phenolic acids) changed significantly during the course of the experiment, but only magnesium and urea had significant trial ×

TABLE 4

Influence of Chlorpromazine on Chronic Schizophrenic Males, Urinary Variables

Variable	Therapy Group	Weeks			Statistical Details			
		12	18	24	$\sqrt{MS_w}$	MS_{e1}	MS_{e2}	Significant "F" ratios
Electrolytes (mg/hr)								
Sodium c.d.: bg = 22.5; bt = 8.4	PP TP PT TT	81.4 113.0 123.5 129.4	95.4 115.4 141.5 140.8	80.5 89.4 129.9 127.7	49.38	5418	1031	bg – 9.12 bt – 8.41
Potassium c.d.: bg = 11.1; bt = 4.9	PP TP PT TT	52.0 65.7 75.3 74.7	53.1 62.5 76.2 82.1	45.0 50.6 64.9 66.2	25.90	1316	349	bg – 8.83 bt – 13.3
Magnesium c.d.: bg = .79; bt = .27	PP TP PT TT	3.25 3.40 3.07 3.44	3.88 4.01 3.77 3.98	4.63 3.33 3.68 4.02	1.706	6.66	1.03	bt – 14.6 t × g – 2.46
Calcium c.d.: bt = .49	Mean	7.32	8.19	8.08	3.230	24.4	3.41	bt – 8.35
Phosphate (as P) c.d.: bt = 1.9	Mean	35.0	39.6	35.6	11.33	278	53.4	bt – 10.4
Sodium/Potassium* c.d.: bt = .15	Mean	1.70	1.92	1.97	.778	1.17	.324	bt – 6.47
Magnesium/Calcium* c.d.: bt = none	Mean	.48	.49	.48	.165	.0350	.0233	none
Calcium/Phosphate* c.d.: bt = .01	Mean	.21	.21	.23	.0724	.0100	.00287	bt – 4.62
Nitrogenous Compounds (mg/hr)								
Urea c.d.: bg = 111; bt = 45	PP TP PT TT	730 851 766 824	758 874 944 881	739 719 856 868	252.3	131,000	30,100	bt – 6.40 t × g – 2.74
Uric Acid c.d.: bg = 2.2; bt = 1.0	PP TP PT TT	15.7 17.9 18.6 20.7	13.9 14.2 18.5 18.2	14.3 14.0 18.2 18.8	5.28	53.8	14.9	bg – 8.69 bt – 11.3
Creatinine c.d.: bt = 2.8	Mean	61.1	67.2	64.8	17.72	713	115	bt – 9.37
Uric Acid/Creatinine* c.d.: bg = .03; bt = .01	PP TP PT TT	.28 .31 .33 .32	.23 .22 .27 .26	.24 .24 .28 .26	.0771	.00978	.00314	bg – 4.36 bt – 44.6
Creatine c.d.: bt = .25	Mean	3.75	2.95	2.68	1.338	3.48	.94	bt – 35.3
Tryptophane + Valine + Methione c.d.: bg = .16; bt = .06	PP TP PT TT	— — — —	.60 .78 .88 .68	.58 .68 .77 .67	.344	.191	.044	bg – 3.32 bt – 4.39

TABLE 4—*Continued*

Variable	Therapy Group	Week			Statistical Details			
		12	18	24	$\sqrt{MS_w}$	MS_{s1}	MS_{s2}	Significant "F" ratios
Nitrogenous Compounds (mg/hr)—Continued								
Phenylalanine c.d.: bg = .10; bt = .04	PP TP PT TT	— — — —	.28 .32 .32 .31	.28 .20 .31 .34	.224	.071	.0289	t × g — 2.68
Tyrosine c.d.: bt = .13	Mean	—	.64	.32	.497	.260	.234	bt — 24.4
Aspartic Acid + Serine + Glycine	Mean	—	1.5	1.5	.519	.411	.128	none
Glutamic Acid + Threonine c.d.: bt = .05	Mean	—	.80	.69	.293	.131	.041	bt — 14.8
α-Alanine + β-Alanine	Mean	—	.66	.62	.230	.107	.040	none
Leucine + Isoleucine, etc. c.d.: bt = .04	Mean	—	.34	.25	.220	.0715	.0251	bt — 18.5
Cystine + Peptides c.d.: bt = .13	Mean	—	.99	.86	.254	.107	.023	bt — 4.34
Histidine Colorimetric c.d.: bt = .2	Mean	7.5	8.6	7.7	1.14	1.88	.725	bt — 8.40
Chromatographic (Diazotized sulfanilic acid-2 spots combined) c.d.: bt = .1	Mean	—	2.3	2.9	.48	.318	.133	bt — 17.9
Lysine + Asparagine + Histidine c.d.: bt = .3	Mean	—	5.2	4.8	2.07	6.85	1.71	bt — 5.45
Arginine + Glutamine + Taurine c.d.: none	Mean	—	3.3	3.6	1.54	3.51	1.20	none
Steroids and Phenolic Acids (μg/hr)								
c.d.: bt = 21 17-hydroxycorticosteroids	Mean	192	218	188	117.8	28,915	6375	bt — 3.81
One Dimensional Chromatography[5], (Butanol-Acetic Acid-Water), Diazotized Sulfanilic Acid (DSA)								
DSA Pink spot Rf 59 Unknown Ref. std. 3 methoxy-4-hydroxybenzoic acid c.d.: bg = 15 bt = .10	PP TP PT TT	.58 .71 .74 .81	.55 .57 .87 .75	.42 .55 .67 .67	.428	.257	.146	bg — 4.18 bt — 3.77
DSA Orange spot Rf .75 Mixture including: m-hydroxybenzoic acid (Ref. std.) + m-hydroxyhippuric acid c.d.: bt = .17	PP TP PT TT	.77 .90 1.06 .75	.81 .69 1.19 1.20	.95 .92 1.58 1.21	.959	1.42	.416	bg — 2.43 (n.s.) bt — 6.00 bg groups presented due to trends of therapy groups

TABLE 4—*Continued*

Variable	Therapy Group	Weeks			Statistical Details			
		12	18	24	$\sqrt{MS_w}$	MS_{e1}	MS_{e2}	Significant "F" ratios
One Dimensional Chromatography, (Butanol-Acetic Acid-Water), Diazotized Sulfanilic Acid (DSA)—Continued								
DSA Brown-Purple spot, Rf. 84. p-hydroxyphenyl-acetic acid (Ref. std.), p-hydroxyphenyllactic acid c.d.: bg = .4; bt = .2	PP TP PT TT	1.4 1.7 2.0 1.8	1.6 1.9 2.8 2.3	2.2 2.0 3.0 2.6	1.03	1.84	.679	bg — 6.86 bt — 22.1
By 2-dimensional chromatography	Mean	—	1.2	1.2	.900			none
Two Dimensional Chromatography[6] (DSA) Rf = NH_3 system/BenzP system								
DSA Yellow spot Rf .37/.00. Possibly Armstrong's (17) spot 9, p-hydroxymandelic acid c.d.: bg = .04; bt = .03	PP TP PT TT	— — — —	.34 .38 .41 .43	.40 .39 .42 .48	.112	.015	.010	bg — 6.51 bt — 6.29
DSA Orange spot, Rf .34/.10. Possibly Armstrong's (17) spot 4, p-hydroxyhippuric acid. See 1-dimensional data above c.d.: bg = .10	PP TP PT TT	— — — —	.09 .08 .21 .17	.17 .07 .22 .18	.239	.074	.041	bg — 2.78
DSA Orange spot, Rf .50/.15. Possibly Armstrong's (17) spot 2, m-hydroxyphenylhydracrylic acid c.d.: bg = .16	PP TP PT TT	— — — —	.47 .30 .51 .42	.42 .28 .53 .42	.359	.192	.066	bg — 2.78
DSA Orange spot, Rf .66/.00. Unknown. Possibly Armstrong's (17) spot 2	Mean	—	.24	.29	.167	.036	.020	none
DSA Orange spot, Rf .44/.10. Unknown. Possibly Armstrong's (17) spot 3, m-hydroxyhippuric acid (see 1-dimensional data above) c.d.: bt = .06	Mean	—	.42	.50	.352	.196	.0518	bt — 9.13

* Ratios were computed from the entire data, and may differ slightly from ratios computed from the group means.

group interactions (Table 4); *i.e.*, they changed directly with respect to the treatment protocol. The other changes probably were due to the summer temperature rise and/or to the general psychiatric change. The placebo groups (PP, TP) excreted less ($P < 0.05$) sodium, potassium, urea, and uric acid, and the uric acid/creatinine

ratios were low. This tendency for the mean scores of the placebo groups to be depressed was evident by the end of the experiment also in the following variables: phosphate, corticosteroids, all the phenolic acid spots, and the sodium/potassium ratios. Individually, however, these were not significant, but collectively they are indicative of deep-seated physiological changes.

The magnesium and calcium data are inconsistent. The excretion of both increased rather consistently during the first six weeks in all groups, but thereafter group distinctions became evident. The two groups on which treatment was reversed in the middle of the experiment (PT, TP) decreased moderately while the others (PP, TT) increased moderately. Patients on chlorpromazine therapy excrete elevated quantities of fluorescent metabolites which might yield high values for calcium and magnesium, since the EDTA titration used involves a fluorescent indicator. The PP group had the highest values, however, so this possible titration error would not alter the general results; rather, the chlorpromazine groups (TT, PT) possibly may have excreted even less than the values indicate.

SERUM VARIABLES. The serum constituents, like the urinary ones, changed significantly during the experiment (Table 5). The TP group, however, tended to change much less than the others. This fact obscures otherwise distinct group differences. The placebo groups (PP, TP) had the highest means with four variables, but in no case was a chlorpromazine group highest. Protein-bound iodine had a significant interaction (there was an increase on trial 3 in all groups but TP) consistent with the final increased tension, anxiety, and disturbance of the PP group (the PBI was elevated in both the PP and TP groups). There was an increase in cholesterol in all groups except in the already low PP group. Chlorpromazine has been reported to cause elevated serum copper in about half of a group of schizophrenics (2), and it was significantly low in the PP group, but inconsistently, TP yielded the highest copper values.

GENERAL CONSIDERATIONS. From a cursory examination of the data it seemed that the intermediate groups (TP and PT) most often had the highest or lowest means on any trial, possibly as a result of the change in drug regimen that characterized only these two groups. This was not the case, however, as the TT and PP groups had high or low means as often as did the TP and PT groups. This observation was based on the rank order of the groups at each trial without regard to the magnitude of the differences. It seems unlikely, therefore, that the change in drug regimen at the midpoint of the experiment, just prior to the first chemical study materially altered metabolic processes. For some unknown reason, by the time trial 3 was made the TP group excreted the least phenolic acids.

The rapidity with which the replacement or withdrawal of chlorpromazine therapy influenced the variables varied widely. Following withdrawal behavior was not altered significantly for periods of over three months, and replacement (PT) within this period prevented regression (12). Similar patterns of persistent effect after withdrawal (TP) but of immediate response

[5] To increase precision maximally in the time available one-dimensional paper chromatography was used even though this failed to resolve all the acids. The solvent was butanol–acetic acid–water. Equal urinary aliquots were used (rate determined arithmetically) and 10 distinct ninhydrin-positive spots were estimated with a densitometer. Standards were included on each sheet due to the wide sheet-to-sheet variation.

[6] Solvent used for one-dimensional chromatography was butanol–acetic acid–water; for two-dimensional chromatography, isopropanol–aqueous ammonia–water, and benzene–propionic acid–water. Both were developed with diazotized sulfanilic acid (DSA) and estimated with a densitometer. Urine was applied so that each spot contained the urine from equal fractions of time and rate was determined directly. Histidine was determined on both ninhydrin and DSA papers, as well as colorimetrically.

TABLE 5

Influence of Chlorpromazine on Chronic Schizophrenic Males, Serum Variables

Variable	Therapy Group	Weeks		Statistical Details			
		18	24	$\sqrt{MS_w}$	MS_{e1}	MS_{e2}	Significant "F" ratios
Sodium (meq/l) c.d.: bg = 3; bt = 2	PP	151	146	8.69	81.3	70.0	bt – 5.54
	TP	145	147				t × g – 2.94
	PT	149	143				
	TT	149	145				
Potassium* (meq/l) c.d.: bt = .1	PP	4.40	4.23	.486	.327	.145	bt – 10.0
	TP	4.14	4.34				
	PT	4.25	4.08				
	TT	4.31	3.98				
Inorganic Iodine (μg/100 ml)	Mean	—	4.1	2.10	—	—	none
Protein-bound Iodine* (μg/100 ml) c.d.: bt = .3	PP	5.6	6.2	1.32	2.28	1.22	bt – 20.7
	TP	5.4	6.1				
	PT	5.3	5.7				
	TT	4.8	5.9				
Copper* (μg/100 ml)	PP	143	139	Average Standard Deviation: 24 "t" tests only—PP was significantly lower than TT, PT, but also TP.			
	TP	161	164				
	PT	159	149				
	TT	155	147				
Cholesterol (μg/100 ml) c.d.: bg = 17; bt = 6	PP	214	214	42.3	2985	593	bg – 3.36
	TP	221	228				bt – 9.63
	PT	237	255				
	TT	231	246				

* Presented in detail to show trend.

upon replacement (PT) were evident in the trends of urinary sodium, potassium, phosphate, 17–hydroxycorticosteroids and phenylalanine. Other variables responded immediately to either withdrawal (TP) or replacement (PT), *e.g.*, urine flow rate, urinary p-hydroxyphenylacetic acid and serum cholesterol. Replacement (PT) did not immediately influence serum PBI, but withdrawal (TP) did. Several urinary variables responded sluggishly to either withdrawal or replacement, *e.g.*, urea, uric acid, and p-hydroxymandelic acid.

CONCLUSIONS

During the initial three month phase all four groups underwent an apparent behavioral deteriation. The initial MSRPP scores were around 15, but during the first three months these increased in all groups by at least two units. This uniform rise was attributed by the authors largely to an increasingly more critical administration or rating of the test by research personnel (12). During the final three month phase all groups but PP returned to their initial level. The factors contributing to these trends are difficult to evaluate, since there were large seasonal differences between the two phases of the experiment. During the latter phase, in the prolonged heat of summer, the ward and research personnel, as well as the patients, undoubtedly slept poorly and became more irritable and lethargic. Activity levels and appetites are reduced under these conditions, and in turn these are influenced by chlorpromazine. Thus in the longitudinal effect of chlorpromazine therapy there is a subtle interaction with the seasonal changes. The de-

teriorated behavioral and mental condition of many patients in the PP group are even more meaningful in this light. The general, though not uniform by any means, response of patients in the PP group was a marked regression in behavior starting by the 12–16th week of withdrawal. This regression was characterized by the return of the hallucinations, delusions, ritualism, incoherence, and confusion that constituted the patients' symptomatology prior to successful treatment with chlorpromazine. There was no relation between the duration of previous chlorpromazine therapy and the tendency to regress on its withdrawal (12).

Body weight changes appear to be very sensitive gauges of the therapeutic regimen of each group. These changes are interrelated with appetite, food intake, activity, and anxiety, which in turn are related to diet, environment, and chlorpromazine therapy. The chlorpromazine groups (TT, PT) as a result of the therapy may have been in better physical condition, and therefore, adapted to the heat more readily (3). Any of these factors could influence body weight. The fact that all variables changed with time, along with the changes in psychiatric condition, makes it seem that all these factors were operative and that they are inextricably intermingled. The elevated potassium, urea, uric acid, and phosphate excretion (the latter was not shown to be significant) in the groups receiving chlorpromazine, coupled with their weight gains, are indicative that the condition of the appetite regulating mechanism was improved by the drug, or at least that these patients ate more. Furthermore, the elevated sodium excretion makes it appear certain that they had an increased intake of salt. This might have resulted from increased food consumption *per se* (compulsive eating), or because they were more aware of the food and its taste and they desired more salt on it, or they took salt tablets more regularly, or their liquid intake and consequent sodium intake was higher (supported by their elevated urine flow rate) or a combination of these. Any of these changes could be attributed to an indirect action of chlorpromazine therapy. At any rate this increased sodium intake could have influenced body weights by causing an increased retention of tissue fluids with or without (as in hypoproteinemia) a concomitant sodium retention. An imbalance of this kind could arise only from a net excess intake over output, and would require a balance study to confirm. The increased food consumption (as evidenced by the elevated urinary urea, uric acid, etc.) seems much more likely to account for the weight gains, rather than water retention. This is especially true in view of the increased urine flow rates of the TT and PT groups. The electrolyte and urea load (diuretic *per se*), and the possibly high liquid intake undoubtedly contributed to the elevated urine flow rate of these groups. These matters are best evaluated in correlational studies, and a subsequent publication considers this problem.

Most of the significantly clear-cut cases of group differences appear in variables known to be related to stress, such as urinary sodium, potassium, uric acid, and uric acid/creatinine ratio, and serum cholesterol and sodium. Indirectly also, the stress factors are related to body weight changes, urinary urea, and urine flow rates. No simple correlation with response to stress is possible, however, since by the end of the experiment the two placebo groups (PP and TP) were lower than the TT and PT groups in all these (except serum sodium) as well as most of the other variables. In agreement with Bass, *et al.* (3), there was little evidence of increased adrenocortical activity as a result of the long term heat exposure, *e.g.*, 17–hydroxycorticoids and the uric acid/creatinine ratios decreased while the urinary sodium/potassium ratios increased. These changes may be indicative of some deep-seated effect, or, what is more likely, of group

differences that are due more or less completely to an indirect effect of chlorpromazine therapy, *i.e.*, improved mental state, appetite, fluid balance, normal activity, etc.

Within any group there were individual schizophrenics whose chemistry, mental activity and behavior would, in the absence of knowledge of their therapy group category, appear to place them into another. For example, in the PP group, which as a whole deteriorated psychiatrically, there were individuals who improved, and the reverse happened in the TT groups. Apparently, as is the case with most therapeutic procedures, including electric and insulin shock, chlorpromazine is decidedly more beneficial to some individuals than others. For these reasons it is impossible to draw clear–cut conclusions on the possible value of chlorpromazine for an individual schizophrenic patient.

SUMMARY

The influence of withdrawal and renewal of chlorpromazine therapy on behavior, mental function and body chemistry was investigated in 112 chronic male schizophrenics. Four groups of patients were studied concurrently, all of whom were receiving chlorpromazine at the outset: TT (chlorpromazine throughout the six month experimental period), PP (placebo throughout), TP (chlorpromazine for three months followed by placebo for three months), and PT (the converse of TP). This report concerns the chemical studies made at six–weeks intervals during the final three months of the experiment.

In addition to behavioral changes there were significant physiological and biochemical differences that were attributable either directly or indirectly to chlorpromazine therapy. Body weight increased, and urinary flow rate, sodium, potassium, urea, uric acid, and the uric acid/creatinine ratio, phenylalanine, the DSA one–dimensional phenolic acid spots, and three of the two–dimensional ones, and serum cholesterol were elevated significantly by the end of the experiment in either the TT or PT groups or both. Their serum sodium, potassium and protein–bound iodine were depressed slightly. Urinary magnesium differed significantly between the groups; but these results and those of calcium were inconsistent. Serum copper was significantly lower in the PP group, but it was highest in the TP group. According to the behavioral ratings (MSRPP) and psychological tests, the psychiatric condition of the PP group had deteriorated by the end of the experiment. Marked changes also occurred in all variables (except some of the amino and phenolic acids) from one six-weeks trial to another, but these could not be related unequivocally with the psychiatric changes because of the concomitant seasonal and dietary differences. There were distinct indications that acclimatizations to heat occurred in most patients, but more so in those receiving chlorpromazine. Aside from these longitudinal changes the following variables showed no significant group differences: psychological tests; the urinary variables, sodium/potassium ratio, magnesium/calcium ratio, calcium/phosphate ratio, the excretion rates of calcium, phosphate, creatinine, creatine, all amino acids (except phenylalanine and the tryptophane + valine + methionine spot), 17-hydroxycorticosteroids, and two unknown phenolic acids; and serum variables, levels of potassium, inorganic and protein-bound iodine.

The beneficial effects of chlorpromazine therapy possibly are due to a substantial extent to the fact that the condition of the appetite and other regulatory mechanisms in the brain, and the overall metabolic activity are improved. The patients receiving chlorpromazine ate more, consumed more liquid and salt and slept better. It is certain that most of them were improved physiologically by the long–term therapy.

REFERENCES

1. Armstrong, M. D., Shaw, K. N. F. and Wall, P. E. The phenolic acids of human urine. J. Biol. Chem., **218**: 293–303, 1956.
2. Azima, H. and Richman, A. Alteration of copper metabolism in chlorpromazine treated cases. A.M.A. Arch. Neurol. & Psychiat., **75**: 163–166, 1956.
3. Bass, D. E., Kleeman, C. R., Quinn, M., Henschel, A. and Hegnauer, A. H. Mechanisms of acclimatization to heat in man. Medicine, **34**: 323–380, 1955.
4. Beckman. Instructions for the Beckman Flame Spectrophotometer, Bulletin No. 259A, Beckman Instruments, Inc., Pasadena, Calif., 1952.
5. Betz, J. D. and Noll, C. A. Total hardness determination by direct colorimetric titration. J. Am. Water Works Assoc., **42**: 49–56, 1950.
6. Buros, O. K., Ed. *The Fourth Mental Measurements Yearbook*. The Gryphon Press, Highland Park, N. J., 1953.
7. Clark, L. D. and Thompson, H. L. Determination of creatine and creatinine in urine. Anal. Chem., **21**: 1218–1221, 1949.
8. Duggs, R. B., Ed. Methods in environmental medical research. In *Methods in Medical Research*. Vol. 6, pp. 39–120. Year Book Publishers, Inc., Chicago, 1954.
9. Eggelton, P., Elsden, S. R. and Gough, N. The estimation of creatine of and diacetyl. Biochem. J., **37**: 526–529, 1943.
10. Fiske, C. H. and Subbarow, Y. The colorimetric determination of phosphorus. J. Biol. Chem., **66**: 375–400, 1925.
11. Gawienowski, A. M. and Layton, M. C. A modified procedure for the determination of copper in serum. (MSS.)
12. Good, W. W., Sterling, M. and Holtzman, W. H. Termination of chlorpromazine with schizophrenic patients. Proc. Central Psychiat. Assoc. 33rd Annual Meeting., Dallas, Texas, 1957.
13. Goodenough, F. L. *Measurement of Intelligence by Drawings*. World Book Co., Yonkers, 1926.
14. Grossman, A. and Grossman, G. F. Protein-bound iodine by alkaline incineration and a method for producing a stable cerate color. J. Clin. Endocrin. and Metabolism, **15**: 354–361, 1955.
15. Hutchinson, J. C. D. The colorimetric estimation of uric acid in fowl's excreta. Biochem. J., **35**: 81–90, 1941.
16. Kleiber, M. Body size and metabolic rate. Physiol. Rev., **27**: 511–514, 1947.
17. Lindquist, E. L. *Analysis and Design of Experiments*. Houghton Mifflin Co., Boston, 1953.
18. Lorr, M. Multidimensional scale for rating psychiatric patients. Hospital form, Washington, D. C.: Veterans Administration T. B., 10–507, 1953.
19. MacPherson, H. T. Modified procedures for the colorimetric estimation of arginine and histidine. Biochem. J., **36**: 59–63, 1942.
20. Pascal, G. R. and Suttell, B. J. *The Bender Gestalt Test: Its Quantification and Validity for Adults*. Grune and Stratton, New York, 1951.
21. Pearson, S., Stern, S. and McGavack, T. H. A rapid procedure for the determination of serum cholesterol. J. Clin. Endocrin. and Metabolism, **12**: 1245–1246, 1952.
22. Peterson, R. E. and Bollie, M. E. Spectrophotometric determination of serum copper with biscyclohexanoneoxyldihydrazone. Anal. Chem., **27**: 1195–1197, 1955.
23. Schwarzenback, G., Biederman, W. and Bangerter, F. Complexons VI. New simple titrating methods for determining the hardness of water. Helv. Chim. Acta, **29**: 811–818, 1946.
24. Smith, R. W., Jr., Mellinger, R. C. and Patti, A. A. Modification of the Reddy procedure for 17-hydroxycorticoids in urine. J. Clin. Endocrinol. and Metabolism, **14**: 336–338, 1954.
25. Watt, W. G. and Cripp, J. P. Quantitative determination of urea. Anal. Chem., **26**: 452–453, 1954.
26. Young, M. K., Jr., Berry, H. K., Beerstecher, E. and Berry, J. S. Metabolic Patterns of Schizophrenic and Control Groups. p. 189–197. Biochemical Institute Studies IV, Univ. of Texas Publ. 5109, 1951.

SUGGESTED BIOCHEMICAL FACTORS IN SCHIZOPHRENIA

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Hoffer, Osmond and Smythies (13) have proposed that epinephrine metabolites may be a causative factor in schizophrenia and have recently claimed the existence of adrenochrome in the body (15). The problem has been to explain how the organism produces oxidized epinephrine. Since critics of this theory state that while it may be true that a synthetically degraded form of epinephrine can cause psychotic-like symptoms, there has been no explanation as to how epinephrine degradation takes place in the body. Another problem is how the organism is affected by the epinephrine breakdown products to produce psychosis.

It is the aim of this paper to outline a detailed physiological circuit with specific biochemical action which we suggest is a means by which epinephrine production in the body can become faulty and cause schizophrenia. It should be understood, however, that we are outlining a fundamental and simplified circuit for we feel that the implications of the circuit can lead to much more complex interconnections, which entered into at this point, might obscure the basic reasoning that is being set forth. It is hoped that some of the hypotheses suggested here will be of sufficient interest for investigation by others.

It is our thesis that epinephrine, acting as an iron-binding agent, can pick up iron from ferritin, stored in the reticulo-endothelial system, particularly in the liver and spleen, and in so doing becomes oxidized thus becoming a psychosis-producing substance. This action could lead to a vicious cycle of self-stimulation of psychosis-producing secretion, since epinephrine when transformed in this manner loses much of its vasoconstrictor effects. The loss of epinephrine's physiological effects is made known principally to the hypothalamus which, in order to meet the homeostatic needs of the organism, allows for the outpour of additional epinephrine, which in turn picks up more iron from the ferritin in the R.E.S. and continues the unfortunate situation.

It has been suspected for some time that the liver is implicated in psychosis. There have been other phenomena which have stood by themselves as interesting facts, but have not been correlated into any unified theory. For example:

1. Statistics show that people suffering from diabetes mellitus are not prone to schizophrenia (11).

2. Allergies such as asthma are statistically rare among schizophrenics (5, 1).

It is suggested that the mechanism involved in the above examples is the actual curtailment of epinephrine, while in schizophrenics there is an overproduction of epinephrine. (Little epinephrine is lost in excretion indicating that its metabolites have physiological importance still not clear.) The theory therefore has predictive value in that it postulates a greater outpouring of epinephrine in schizophrenia specifically.

The hypothalamus is involved in a complex manner with the aforementioned problems. Inasmuch as it controls the secretion of epinephrine and nor-epinephrine chiefly through the adrenal medulla, it is a participant in the blood-sugar-regulating system, including the liver. It has even been suggested that insulin secretions may in part be regulated at the hypothalamic level (6). Considering iron metabolism as a unifying factor in our discussion, some form of hypothalamo-hypophysial interaction is indicated, since the neurohypophysis plays a

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role in connection with certain ferritin levels (2). The possible involvement of the hypophysis with the adrenal cortex, as well as the relationship of epinephrine to the mobilization of adrenocortical hormones illustrates the varied ramifications of hormonal influences, which by their actions, interconnect neural circuitry relating to mental activity. Therefore, what may appear to be a simple circuit drawn to a particular protein, such as transferrin, is probably part of an interlocking network in the wide panorama of metabolism. Indeed, it would appear that groups interested in the biochemistry of schizophrenia are similar to the blind men and the elephants. For evidently the groups who are investigating adrenocortical steroid hormones in this respect may be just examining the other leg of the same animal that is being studied by the proponents of the degraded epinephrine theory.

The liver, as a storehouse for iron, is probably involved in iron metabolism through two proteins, ferritin and transferrin. Ferritin, in the liver, stores and is composed of over 20 per cent iron. Ferritin, itself, is not found in the bloodstream, except possibly in some pathological states (25). Transferrin, the circulating, iron-binding agent, binds iron from ferritin. It is known that the oxidation of epinephrine causes it to lose much of its physiologic effects (12). Also of interest is that the addition of iron to epinephrine causes it to assume a color similar to the "pink" epinephrine which gave indications of being a psychotomimetic agent (12, 13).

Mazur, Green and Shorr (22) in their investigations concerning shock, found that epinephrine can in certain physiologic conditions, become a "powerful iron-binding agent". Their studies indicate that a small portion of ferritin iron is capable of dissociation in combination with iron-binding agents.

Epinephrine, as an iron-binding agent, can remove ferritin iron from the liver under certain conditions. Epinephrine is a well-known hyperglycemic agent by virtue of the fact that it mobilizes sugar from the liver. In a diabetic, one may postulate therefore that epinephrine production is suppressed, since a hyperglycemic state would tend to signal the curtailment of epinephrine production by homeostatic means.

We hypothesize that one reason asthmatics are not prone to schizophrenia is because they suffer from a relative lack of epinephrine. Following the above theory, in order to have schizophrenia, one must have a statistical chance of releasing enough epinephrine so that iron-binding is possible. It is known also that epinephrine, when injected into psychoneurotics or psychotics, exaggerates their conditions (20). Puerperal psychosis can also be linked with our theory. The liver is active in a pregnant woman in building up iron supplies. The possibility exists that epinephrine levels in women postpartum who have uterine inertia are quite high (14). If for some reason the high rate of iron storage is not dissipated rapidly enough by either the trauma of birth or the normal metabolic processes, it would seem likely that a high level of epinephrine plus high levels of iron stored in the liver and spleen could equal psychosis.

As noted (24), the circulation of the changed form of epinephrine could affect *the organism's reaction to environment by changing temporal conductivity of information*. The timing change may be slight and yet have a cascading effect, since information usage depends upon the proper interlocking action of many signals in time. There would be a disruption of brain functioning by the supplying of "false" (improperly timed) information, and the involvement of other neural circuits not called for in the original response to environmental stimuli.

The increased circulation of degraded epinephrine may have yet another effect, since various localized brain areas could be sensitized to such substance and through irritative action, cause spontaneous activ-

ity, thus creating false information. It is known that iron is found in varied forms in the brain, and according to Diezel (4), pathological increase of "physiological brain iron" has been noted in psychosis. Iron content in cerebrospinal fluid of schizophrenics has been found to differ quantitatively (16, 19). Using both concepts, that of supplying as well as creating false information, one need only say that if false information is given to the integrating centers, it is the same as if the integrating centers are producing false information. The complexities of physiological involvements from changes of the liver and spleen can have many diversified reactions on the functions of the nervous system.

Protein content tests, made for Dr. Morris Goodman and the writer, utilizing Dr. Goodman's immunochemical method (8, 9, 10) showed that in the serum[2] of sixteen schizophrenic patients, there was an average decrease of 16 per cent in transferrin levels from that of eleven normals. Due to the size sample, these figures are of a provisional nature and further work is being undertaken. The writer, however, is assuming the possibility of a transferrin decrease as part of the theory elaborated here. It is interesting to note that in a group of five schizophrenics, there is indication that shock therapy increases transferrin levels. The writer's explanation of this apparent inequality is that there is possibly a transferrin-epinephrine antagonism, since they both compete with iron from the ferritin stores of the schizophrenic. The mechanism of this action is still not certain. It is possible that shock builds up transferrin levels which bind more iron therefore leaving less to be absorbed by epinephrine. Buttressing this suggestion, is the fact that shock markedly decreases adrenochrome levels in the organism (14).

It is felt that regardless of the results of transferrin sampling, it need not be postulated that transferrin is necessarily lower in schizophrenics. The reason that transferrin may not be lower is that transferrin may bind all the iron of which it is capable and still there may be more iron available to be bound by epinephrine. Therefore, a greater amount of epinephrine circulating may be of more importance than any small variations of transferrin. Since transferrin does not become saturated with available iron, any agent which would increase its binding capacity could be a therapeutic help.

In schizophrenics the reticulo-endothelial system may utilize its iron metabolism differently. There are varied mechanisms which may be involved and these will be the subject of another paper.

It is suggested that any agent which could be put into the bloodstream that could bind iron and thereby decrease the iron available to epinephrine could be a therapeutic aid in the treatment of schizophrenics. Transferrin, devoid of its iron, is the first such agent that should be tried.

It is not intended to suggest that there are no other oxidizing mechanisms involved in the breakdown of epinephrine as a cause of schizophrenia, or that there is no interrelationship between other forms and those discussed here. Ceruloplasmin (18) has been implicated in this process. It is well known that copper is involved with iron's utilization in hemoglobin formation. It has been quoted by Gilman and Goodman (7) that when the diet is copper-free, iron storage in the viscera is enhanced. When copper is supplied, a larger portion of the storage iron is utilized in blood formation". There is a definite relationship between copper content in the liver and spleen and the amount of iron stored. As Bard (3) pointed out "a very interesting synergism between iron and copper" is that iron salts fed to rats are ineffective in some types of anemia unless a trace of copper is added. Transferrin even loosely binds copper (17) and copper can be displaced by iron in transferrin under certain conditions.

[2] Furnished by Dr. C. Frohman of the Lafayette Clinic, Detroit.

A hypothesis that can be checked concerning the use that is being made of ceruloplasmin in the treatment of schizophrenics (21) would be that transferrin levels could go up in some cases when a large amount of ceruloplasmin is given. The use of ceruloplasmin should tend to cause a greater amount of copper storage and usage. This in turn would act to utilize the stored iron and in order to do this transferrin production should be stimulated. Ceruloplasmin would indirectly act to raise transferrin activity to adjust for the increase of iron storage and by so doing compete with epinephrine for available iron. In any case, using the immunochemical method, transferrin levels can be correlated with any treatment which seemingly would hold promise for remission of schizophrenia.

There are some interesting facts which indicate the various underlying biochemical processes that may be involved, such as the knowledge (23) that "metals stimulate nonenzymatic transamination" and iron plays an important catalytic role as it "is quantitatively the most important metal concerned in enzymatic activity" (23). Because of its chelating action, it may be involved in many different interactions. While this article is not meant as a review of the role of iron in metabolism, the peroxidasing effect of which the iron atom plays a part in hemoglobin and hemin, as well as its effect in catalase or peroxidase, would indicate that the study of schizophrenia will have to descend to the level of atomic structures of iron and other heavy metals, tracing metabolic activities by many methods. A clue could reside in the pH reactions at which the epinephrine can become oxidized and try to match this with the pH levels of various organs so as to better determine the probable site of activity. Possibly, there has been too much interest in blood pH and not enough in the pH action in local areas.

In the immunochemical study mentioned above, where we compared various serum proteins in schizophrenics and in normals, no significant difference in the levels of ceruloplasmin was found. However, it may be the relationship between ceruloplasmin and transferrin that is important rather than just the quantitative amount of each.

A simplified circuit has been offered with the realization that the tremendous complexities of the interaction of glucose production, epinephrine effects, and the steps of oxidation of epinephrine are involved with many different processes and with various portions of the central nervous system. However, this paper is an attempt to build a foundation which suggests that a physiological system which meets the neural and hormonal requirements of a psychosis-producing circuit can be drawn from the view of epinephrine as an iron-binding agent in psychotics.

REFERENCES

1. Altschule, M. D. *Bodily Physiology in Mental and Emotional Disorders.* Grune & Stratton, New York, 1953.
2. Baez, S., Mazur, A. and Shorr, E. Role of the neurohypophysis in ferritin-induced antidiuresis. Am. J. Physiol., **169:** 123–133, 1952.
3. Bard, P. *Medical Physiology*, pp. 46, 690. C. V. Mosby Co., St. Louis, 1956.
4. Diezel, P. B. Iron in the brain: A chemical and histochemical examination. In Waelsch, H., ed. *Biochemistry of the Developing Nervous System: Proceedings of the First International Neurochemical Symposium, 1954*, pp. 145–152. Academic Press, New York, 1955.
5. Ehrentheil, O. F. Common disorders rarely found in psychotic patients. A. M. A. Arch. Neurol. & Psychiat., **77:** 178–186, 1957.
6. Gellhorn, E. *Physiological Foundations of Neurology and Psychiatry.* Univ. of Minnesota Press, Minneapolis, 1953.
7. Goodman, L. and Gilman, A. *The Pharmacological Basis of Therapeutics.* Macmillan Co., New York, 1941.
8. Goodman, M., Ramsey, D. S., Simpson, W. L., Remp, D. G., Basinski, D. H. and Brennan, M. J. The use of chicken antiserum for the rapid determination of protein components. I. The assay of human serum albumin and gammaglobulin. J. Lab. & Clin. Med., **49:** 151–164, 1957.
9. Goodman, M., Ramsey, D. S., Simpson, W. L., Remp, D. G., Basinski, D. H. and Brennan, M. J. The use of chicken antiserum for the rapid determination of protein components. II. Assay of human serum orosmucoid. J. Lab. & Clin. Med., **50:** 758–768, 1957.

10. Goodman, M., Neuman, H. S. and Ramsey, D. S. The use of chicken antiserum for the rapid determination of protein components. III. The assay of human transferrin. In press.
11. Gottlieb, J. F. Personal communication.
12. Green, S., Mazur, A. and Shorr, E. Mechanism of the catalytic oxidation of adrenaline by ferritin. J. Biol. Chem., **220**: 237–255, 1956.
13. Hoffer, A., Osmond, H. and Smythies, J. Schizophrenia: A new approach. J. Ment. Sc., **100**: 29–45, 1954.
14. Hoffer, A. Personal communication.
15. Hoffer, A. Adrenochrome and blood plasma. Am. J. Psychiat., **114**: 752–753, 1958.
16. Kral, V. A. and Lehmann, H. E. Further studies on the iron content of the cerebrospinal fluid in psychoses. A. M. A. Arch. Neurol. & Psychiat., **68**: 321–328, 1952.
17. Laurell, C. B. Plasma iron and the transport of iron in the organism. Pharmacol. Rev., **4**: 371–395, 1952.
18. Leach, B. E., Cohen, M., Heath, R. G. and Martens, S. Studies of the role of ceruloplasmin and albumin in adrenaline metabolism. A. M. A. Arch. Neurol. & Psychiat., **76**: 635–642, 1956.
19. Lehmann, H. E. and Kral, V. A. Studies on the iron content of cerebrospinal fluid in different psychotic conditions. A. M. A. Arch. Neurol. & Psychiat., **65**: 326–336, 1951.
20. Lindemann, E. The psychopathological effect of drugs affecting the vegetative system. I. Adrenaline. Am. J. Psychiat., **91**: 983–1008, 1935.
21. Martens, S., Vallbo, S. and Melander, B. Administration of ceruloplasmin to schizophrenics. Presented at Amer. Psychiat. Meeting, May, 1958.
22. Mazur, A., Green, S. and Shorr, E. The oxidation of adrenaline by ferritin iron and hydrogen peroxide. J. Biol. Chem., **220**: 227–235, 1956.
23. Neiland, J. B. and Stumpf, P. K. *Outline of Enzyme Chemistry*. J. Wiley & Sons, New York, 1953.
24. Ovshinsky, S. R. A concept of schizophrenia. J. Nerv. & Ment. Dis., **125**: 578–586, 1957.
25. Shorr, E., Baez, S., Zweifach, B. W., Payne, M. and Mazur, A. The antidiuretic action of the hepatic vasodepressor ferritin (VDM) and its occurrence in conditions associated with antidiuresis in man. Tr. A. Am. Physicians, **63**: 39–49, 1950.

PRELIMINARY STUDY OF A NEW ANTI-DEPRESSANT DRUG

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Recently, with the reintroduction of iproniazid as a "psychic energizer," a great deal of interest has been stimulated in the chemical treatment of seriously depressed patients. The search for effective agents for the treatment of depression has been encouraged by the failure of tranquilizers to provide relief in most severe depressions. Preliminary studies with 2-amino-1-(3,4-methylene-dioxyphenyl)-propane hydrochloride (SKF #5) (see Figure 1) led us to feel that it might be a useful drug in this area.

SKF #5 is an analog of the well known central nervous system stimulant and anorexigenic agent, dextro-amphetamine sulfate. Like the amphetamines, it has the property of increasing motor and mental activity. Unlike amphetamine, however, SKF #5 has a very considerable activity in blocking the response to a conditioned escape stimulus. This animal test appears to be one means of identifying compounds which have a potential utility in the management of behavioral changes in the mentally disturbed human. To date, this property has been associated only with agents which have some central depressant activity as well. However, the data on SKF #5 suggests that its effect on a conditioned response is not directly related to generalized depression or stimulation of the central nervous system.

Previous studies in animals (3) and in human subjects (1, 2) indicated that this drug did not produce serious toxic or side effects. The LD_{50} in rabbits was found to be 20 mg./kg. intraperitoneally, and by oral administration in rats was 50 mg.–350 mg./kg. This represents about one-half the toxicity of dextro-amphetamine sulfate.

On the basis of these activities in animals and in a small group of humans, it was felt that SKF #5 merited further trial in a group of schizophrenic patients to determine its tranquilizing properties, and in a group of seriously depressed patients to determine its effectiveness in altering mood.

OBJECTIVES

In a preliminary investigation of this nature, in which expectations of drug efficacy are largely unknown, it was felt that thorough study of smaller groups of patients by as objective an approach as possible was preferable to a large double-blind study. Our intentions were to obtain evidence of efficacy, if any, to derive information on dose range and optimal dose, and to elicit all possible side effects developing during a one-to-four week period of drug usage.

METHOD

All new admissions, in whom the appropriate diagnosis was concluded by two psychiatrists to be unequivocal, were included in the study if they met the following criteria:

1. Their age was between 14 and 65.
2. They had no observable serious physical abnormalities after a physical and laboratory examination.

The patients who were selected were placed on placebo for from three to seven days to offset the effects of prior drugs, to eliminate patients who recover quickly and spontaneously, and to establish a baseline of vital signs and somatic complaints.

In order to objectify as must as possible clinical impressions of patients, an evaluation scheme was established which permitted

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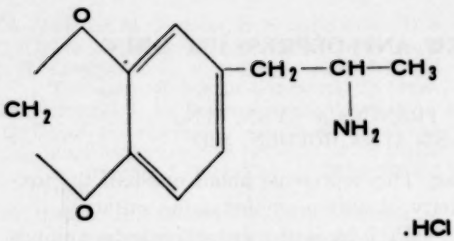

FIG. 1. Structural formula of SKF #5

estimation of the patients' progress from a number of different viewpoints.

1. The patients were evaluated daily by a psychiatrist who made a record of improvement relative to the patient's condition on admission. His function was also to evaluate the patient's physical status and any side effects elicited by him or reported by the nurse assigned to the project.

2. A weekly evaluation was made by means of a 38-item rating scale devised for this study and based on the mental status examination. This was scored by a second psychiatrist, independently of the first psychiatrist's clinical impression, and also without reference to ratings in prior weeks.

3. The hygiene, appearance, relationships, and participation of the patient were rated daily by a psychiatric nurse, whose sole function was to observe the patient and to dispense medication.

4. Psychological tests were obtained on a limited number of patients.

5. Laboratory studies were run once a week, with the first tests done before initiation of drug treatment. The routine tests run in this study consisted of:

Complete blood count
Urinalysis, including determination of bile and urobilinogen
Cephalin flocculation
Alkaline phosphatase
Serum bilirubin

TABLE 1

Results of Treatment of Schizophrenic Patients

Total No. Of Patients	Mean Maximum Dose	Mean Days On Drug	Results		Per cent Improved
			Improved	Unimproved	
32	88 mg.	23	2	30	6

DEFINITION OF TERMS

I. *Diagnosis*

A. Category

Diagnoses follow the official classification of the American Psychiatric Association.

B. Chronicity

1. *Chronic:* This refers to patients who have a history of their present illness for periods exceeding six months prior to admission.
2. *Acute:* This refers to patients in whom there was no history of present illness prior to six months ago.

II. *Clinical Results (Mental Status)*

Severe:[2] Seriously disturbed, withdrawn, or depressed; may be incapacitated by delusions or thinking difficulties. Virtually completely dominated by illness.

SCHIZOPHRENIC STUDY

A total of 32 schizophrenic patients were treated for from six to fifty-four days, with doses ranging from 15 to 225 mg. Only two of these patients evidenced significant clinical improvement. No significant change in either mental status or ward behavior was noted in the other 30 patients. Most of the patients appeared to be somewhat more alert and energetic. However, this effect was insufficient to be reflected in their ratings. The data on these schizophrenics was not subjected to statistical analysis because of the obvious ineffectiveness of the drug on inspection of the results. These results are summarized in Table 1.

[2] All patients in this study were considered to be severely ill.

DEPRESSION STUDY

A total of 25 seriously depressed patients were placed on SKF ⅋5 for periods varying between ten and forty-two days, with doses ranging from 30 to 300 mg. At the same time, another group of patients were placed on placebo. Two patients were assigned to the drug group for each patient assigned to the placebo group, resulting in a final group of 25 patients on active drug and 12 on placebo. Both drug and placebo groups were treated for an average of two weeks, with a range of from ten days to six weeks. A description of the patients is summarized in Table 2.

TABLE 2

Classification of Depressed Patients

	Number of Patients			
	Drug Group		Placebo Group	
	No.	%	No.	%
Diagnosis				
Schizophrenic Reaction, Schizoaffective Type	4	16	2	17
Involutional Psychotic Reaction	12	48	4	33
Psychotic Depressive Reaction	3	12	3	25
Manic Depressive Reaction	1	4	0	0
Neurotic Depressive Reaction, Severe	5	20	3	25
Chronicity				
Acute	12	48	7	58
Chronic	13	52	5	42
Sex				
Male	6	24	2	17
Female	19	76	10	83
Mean Age	47		49	
Total Number of Patients	25		12	

RESULTS

An analysis of changes in the rating scale scores demonstrated a significant drop in the scores of patients on the drug—from 13.1 initially, to 8.7 after treatment. On this scale a lower score indicates improvement. The mean score of the patients on placebo was unchanged (see Table 3). A comparison of the initial scores indicates that there was no significant difference in the severity of illness between the drug and the placebo groups before treatment. The large change in the score of the drug group after treatment is statistically significant (t test: $P < .01$). Analysis of the differences in each group with regard to diagnosis, chronicity, severity, age, or sex indicates that these differences do not significantly influence the results. This statistical data is in accord with a clinical impression of improvement in 76 per cent of the drug group, as compared with 24 per cent of the placebo group.

In addition, seven patients were rotated from drug to placebo and back to drug. Of this group, five patients improved during drug administration and then relapsed in three to five days on placebo. Subsequent readministration of drug resulted in improvement of all five patients. The other two patients improved on drug, but did not relapse after two weeks on placebo.

TABLE 3

Results of Treatment of Depressed Patients

Group	No. of Patients	Number Improved	Mean Rating Scale Scores	
			Pre-Treatment	Post-Treatment
Drug	25	19 (76%)	13.1	8.7
Placebo	12	3 (24%)	14.4	14.4

Four of the depressed patients in the study subsequently had electric shock treatment, either after withdrawal of the drug and relapse, or because of failure to improve on the drug. One of the four improved on the drug and, also, later improved on EST. Three of the patients treated were unimproved on the drug and only one of these subsequently improved on shock treatment.

Inasmuch as it was not possible at the time of the study to maintain patients on

this medication at home, it was necessary to discontinue treatment on all patients. Most patients tended to relapse after discontinuation of the drug and, therefore, required further hospitalization. As a result, a comparison of the final disposition of patients in the drug group and in the placebo group is not meaningful.

The three following case histories will illustrate the clinical findings, and course, in two patients who improved as a result of treatment with SKF ⅋5 and one patient who did not improve.

Case 1. A 57 year old, unmarried woman was brought to the hospital at the suggestion of her physician. In the past few months she had complained of increasingly severe "burning" in the stomach and "whirling in the head." She had been unable to sleep and her appetite was poor. Prior to the onset of these symptoms she had been working and had had no history of previous episodes.

In the hospital she was depressed and agitated, and complained that she had not moved her bowels for two weeks and that her stomach burned. She stated repeatedly that she had "not done enough" to help her ill sister. Physical examination was noncontributory.

A diagnosis of involutional psychotic reaction was made and treatment was begun with SKF ⅋5, 50 mg., t.i.d. In two days the patient admitted to bowel movements, and her agitation was lessened. Therapy was continued for 19 days, with a maximum dose of 75 mg., t.i.d. At the end of that time depression was not evident, and she was eating and sleeping well. Relapse did not occur on withdrawal of drug, and the patient was discharged.

The Rating Scale changed from an initial value of 11 to a low of 1 at termination of treatment. No side effects other than dilated pupils were noted.

Case 2. The patient, a 38 year old married woman, was admitted to the hospital after her husband noted that she had been depressed and tearful for one month. The first episode of depression had occurred 15 years ago and cleared after three month's hospitalization without specific treatment. Since that time she had had periodic mild depressions, but was first hospitalized two months prior to her present admission. At that time she had received eight electric shock treatments and was discharged much improved. After several weeks, however, she again became depressed. She has never had manic episodes.

On examination the patient appeared depressed, tearful and retarded. She was preoccupied with ideas of suicide. She stated that she could not sleep or eat. No delusions or hallucinations were evident, and the patient's sensorium was clear.

A diagnosis of manic depressive reaction, depressed type, was made and treatment was begun with 25 mg. of SKF ⅋5, t.i.d. After several days the dose was increased to 50 mg., t.i.d. With this increase the patient appeared less tense and more relaxed, but remained depressed. A further increase in dose to 75 mg., t.i.d., resulted in clearing of symptoms. The patient reported that she felt well and that her appetite and sleep were restored to normal.

Medication was discontinued on the 12th day of treatment. After two days the patient's original symptoms returned. Medication was reinstituted, and in one week she again improved. When medication was again discontinued, the patient again relapsed. Since it was not possible to continue her on this treatment outside the hospital, she was referred for EST. After 14 treatments she was much improved and was discharged.

The Rating Scale changed from a high of 13 to zero at the peak of improvement. The only side effect noted was mild drowsiness.

Case 3. A 56 year old unmarried woman was admitted to the hospital in a state of agitation and depression. She had been hospital-

ized four years ago with an episode of depression, but was discharged after several weeks without specific treatment.

The present episode started two months prior to her present admission, at which time she began to lose her appetite and was unable to sleep. Before the onset of these symptoms, she had been working full time as a seamstress. Gradually, she had begun to feel depressed and became tearful and agitated. At the time of admission she paced the floor and appeared depressed, tearful and apprehensive. She stated repeatedly, "I'm dying from an incurable illness . . . and my mouth feels like smoke is coming from it." The patient had many other somatic complaints. Her sensorium was clear.

A diagnosis of involutional psychotic reaction was made and treatment was begun with 15 mg. of SKF ⅋5, t.i.d. Dosage was increased to 50 mg. over a period of eight days, with no apparent improvement in status. No side effects other than dry mouth and dilated pupils were noted. However, because of the patient's intense agitation, it was decided to discontinue drug treatment and institute electric shock treatment. She had six treatments over the course of two weeks, without any improvement. During the shock therapy she developed memory impairment and other organic signs. Treatment was discontinued and the patient was ultimately transferred to a state hospital.

Rating Scale scores changed from an initial value of 16 to a post-treatment value of 18.

TOXICOLOGICAL EFFECTS AND LABORATORY STUDIES

Alkaline phosphatase was noted to rise during the drug treatment in twelve patients. In one patient the alkaline phosphatase decreased during the drug trial. Five of the twelve patients who developed elevated alkaline phosphatase were followed further, and in three of these patients the levels returned to normal in from one to three weeks.

No other evidence of liver involvement was noted in these patients.

The most persistent side effects were dilated pupils and dry mouth on higher doses. Other side effects felt to be related to the drug were mild tremors, drowsiness usually during the first few days of treatment, and transient anorexia and insomnia. One patient developed an itching erythematous dermatitis, which disappeared when the drug was withdrawn. This was felt to be an allergic drug reaction. One patient developed marked flushing and sweating when the dose was raised to 300 mg. On subsequent lower doses this did not appear. Another patient had a grand mal seizure after one dose of 30 mg. No history of previous seizures was elicitable. After a second dose on a subsequent day, however, no seizure occurred. The relationship of this seizure to drug ingestion is indefinite. EEG studies of the patient were negative.

Repeated weight determinations were made on 24 patients receiving the drug. Twelve patients lost from one to 8½ pounds, for a mean loss of four pounds over a mean time of 18 days. Eight patients gained from 2½ to 9 pounds, for a mean gain of five pounds over a mean time of 20 days. Four patients maintained a constant weight. No correlation existed between weight change and improvement.

In general, blood pressures tended to drop slightly for the first few days on the drug, but then returned to their base line levels which were maintained throughout the balance of the study.

PSYCHOLOGICAL TESTS

Improved performance on the Wechsler-Bellevue Intelligence Scale, Form I, was noted in some patients receiving the drug. In general, correlation with clinical results was low. Many problems exist in the use of psychological tests for evaluating improvement with drugs, however, and a discussion of these problems is not within the purview of this paper.

DISCUSSION

This drug appears to be of little value in the treatment or tranquilization of schizophrenics. Even in the higher dosage ranges results were few, while the number of side effects increased. The six per cent of the schizophrenics who improved during the study is consistent with what would be expected from hospitalization alone.

The 76 per cent of the depressed patients who improved on the drug constitute a significant number over that of the 24 per cent who improved on placebo. Inasmuch as this improvement was determined by three independent approaches, and as improvement was also noted in the patients' ward behavior, it is felt that this drug is effective in the treatment of some seriously depressed patients.

Further evidence of the efficacy of SKF #5 is seen in the results of the rotation studies. The close correlation between remission and drug administration, and relapse and placebo administration, confirms the effectiveness of the drug. Furthermore, without reference to rating scales, 76 per cent improvement in the drug group of seriously depressed patients is far in excess of what would be expected from spontaneous remission, hospitalization, or other extraneous factors, in a short period of time.

The quality of response, however, is also important. In general, patients' sleep and appetite improved, and apprehension diminished. This occurred despite the close relationship of this drug to the anorexigenic and sleep-inhibiting amphetamines. Nonetheless, the patients who recovered could not be considered cured in the sense that symptoms had entirely cleared. While the subjective feeling of depression and restlessness or retardation disappeared, most of the improved patients appeared tense. Furthermore, withdrawal of the drug usually led to relapse in from three to five days. Whether this tense appearance was due to the drug, or was a residuum of the patient's illness, was difficult to establish. The dilated pupils usually accompanying the use of the drug lent further to this appearance of tension.

The effective dose range appears to be from 60 to 300 mg. per day in divided doses. Initial doses as low as 25 to 30 mg. per day should be given, as initiation of treatment with high doses frequently produced marked tension and apprehension.

The increased alkaline phosphatase and cephalin flocculation in several patients should be further evaluated in longer-range studies.

None of the side effects were of such nature as to interfere with the use of SKF #5 with either in-patients or out-patients.

SUMMARY

1. In this controlled study thirty-two schizophrenic patients were given various doses of SKF #5 without significant improvement.

2. Twenty-five seriously depressed patients were treated with this drug and improvement was noted in 76% of the group.

3. The development of high levels of alkaline phosphatase in twelve patients suggests that further appraisal of these findings should be done in a longer range study.

4. The observable side effects were not of a serious nature.

5. The effective dose appears to be between 60 and 300 mg. per day. Initial doses should be as low as 25 to 30 mg. per day.

REFERENCES

1. Friend, D. G. Peter Bent Brigham Hospital, Boston. Unpublished data, 1956.
2. Hagenauer, F., Rudy, L. H. and Himwich, H. E. A comparative evaluation of two new central nervous system stimulants in severe psychoses. J. Clin & Exper. Psychopath., **18**: 248–257, 1957.
3. Smith, Kline and French Laboratories, Philadelphia. Unpublished data, 1949.

EFFECTS OF ELECTROSHOCK THERAPY ON THE EXCRETION OF EPINEPHRINE[1]

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One of the immediately observable effects of electroshock as applied therapeutically is an increase in the activity of the sympatho-adrenal system, a fact which has long been recognized through clinical and physiological observation (3, 5). Several years ago Weil-Malherbe brought forward the first reliable direct evidence of increased adrenal medullary secretion in man resulting from the application of the electric current with therapeutic intent (15). Using a very sensitive chemical procedure this investigator detected a rise in the concentration of epinephrine in the plasma in electroshock therapy (EST), an increase which persisted even in EST modified by the prior administration of a barbiturate and a skeletal muscle paralyzing drug. The plasma concentration of epinephrine attained maximum values while the current was flowing and returned to normal shortly after its cessation. Although the norepinephrine concentration of the plasma increased in unmodified EST its elevation was abolished by the use of the premedication. Similar findings have since been made by Manger *et al.* (7) and by Griswold (4).

In connection with a program of research in this laboratory on the metabolism of pyrocatecholamines (PCA) in experimental and psychiatric states it was of interest to seek an effect of EST on the excretion of these compounds, *i.e.*, to determine whether the brief, but substantial, rise in the plasma epinephrine concentration is of sufficient dimensions to be reflected in an increased urinary output. Previous attempts (13, 14) in this direction yielded a negative answer, but in those studies the total PCA were estimated as a single entity, without differentiation of the individual members of this group of compounds. Hence a change in the excretion of epinephrine, for example, may have been concealed by non-specific variations in the urinary output of the quantitatively more important compound, norepinephrine. This objection has now been overcome by the use of a chemical method which distinguishes between (a) epinephrine and (b) the other urinary PCA, hydroxytyramine and norepinephrine. With this procedure it has been possible to demonstrate that the rate of urinary excretion of epinephrine following the administration of electroshock does, in fact, increase significantly.

METHODS

Estimation of Pyrocatecholamines. These were determined by a modification of the previously employed procedure (11). The principle of this modification is as follows: the fluorescence due to urinary PCA is determined by oxidation of the catechols (concentrated and purified by the alumina adsorption technique) at pH 6 to fluorescent products; fluorescence due to epinephrine alone is determined by oxidation at pH 3. By the use of suitable standards it is possible to estimate the amount of epinephrine and norepinephrine in the urine samples. Hydroxytyramine present in the urine contributes some fluorescence in this

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method to the norepinephrine fraction. Details of the procedure will be published elsewhere.

Subjects. Two groups of patients were studied: Group A at the Allan Memorial Institute of Psychiatry and Group V at the Verdun Protestant Hospital. Group A consisted of four patients (three females) with the following diagnoses, respectively: reactive depression, involutional psychosis (paranoid type); involutional depression; chronic brain syndrome associated with arteriosclerosis, with behaviour reaction. Group V was made up of 12 male patients diagnosed as follows: schizo-affective reaction, three; manic-depressive, depressed four; involutional melancholia, one; simple schizophrenia, one; catatonic schizophrenia, two; involutional psychosis, paranoid, one. Group A was investigated on a total of 18 days, Group V on a total of 31 days.

Urine Collection. On the days that the patients were administered EST, urine was collected in two periods: the subjects were awakened at about 7 A.M., at which time overnight urine was voided and discarded. Urine voided from this time until shortly before EST was applied (about 9 A.M.) was collected and labelled "Pre-EST sample". Thereafter urine was collected for a further period of approximately 4 hr. This collection was labelled "Post-EST sample". The exact duration of the two collection periods was recorded. EST was usually administered on Monday, Wednesday and Friday. Subjects in Group A were administered oxygen briefly after the electroshock. On the alternate days urine was collected also in two periods of corresponding time of day and duration. These control days permitted estimation of the variation in rate of excretion of PCA during the course of the morning and early afternoon. It is known that the rate of epinephrine and norepinephrine falls markedly during this time from the high values observed after waking (2, 6). Determinations of epinephrine were made on all urine samples received; and norepinephrine was estimated in most of them. Rates of excretion were calculated as mμg. (millimicrograms) per min.

RESULTS

A summary of the data obtained in the two groups of subjects is given in Table 1. The rates of excretion of epinephrine and norepinephrine in the two daily periods on control and EST days are shown, as well as the difference in rate between the two periods of collection. For control days this difference signified diurnal change in output; for experimental days it represented the balance between diurnal variation and the effect of electroshock.

Subjects in Group A received the following drugs as premedication: atropine sulfate, 0.6 mg.; sodium amytal or sodium pentothal in a dose adjusted to the individual case; and succinylcholine, 10–30 mg. In order to have comparable conditions on control days the subjects were administered the same drugs on these days, but without EST.

It can be seen that the determinations made on urines obtained from patients of Group A showed relatively small differences, none of which was statistically significant by the *t* test (10). That is to say, in Group A patients the change in the rate of excretion of PCA from early morning to late morning hours was not significant, either on EST or control days. The possibility was considered that the premedication diminished the sympatho-adrenal responses to EST, providing the results observed. To obviate this possibility it was decided to investigate patients receiving EST modified only by the use of a small amount of Flaxedil[R]. These subjects made up Group V.

In contrast to the results with the first group, it was now observed with Group V that EST had the effect of opposing the tendency to a lower rate of excretion of PCA in the second period of urine collection.

TABLE 1

Effect of Electroshock Therapy (EST) on the Rate of Excretion of Epinephrine and Norepinephrine in the Urine

	NOREPINEPHRINE						EPINEPHRINE					
	Control Day			EST Day			Control Day			EST Day		
	1st Period	2nd Period	Diff.	Pre-EST	Post-EST	Diff.	1st Period	2nd Period	Diff.	Pre-EST	Post-EST	Diff.
Group A:												
Number of samples	7	7	7	10	10	10	7	7	7	11	11	11
Mean rate of excretion (mμg. per min.)	50.3	44.0	−6.3	48.2	51.9	3.7	21.7	15.3	−6.4	14.2	12.4	−1.8
Standard error			22.4			11.2			10.0			2.6
t			0.281			0.330			0.640			0.692
Probability			>.50			>.50			>.50			>.50
Group V:												
Number of Samples	11	11	11	11	11	11	16	16	16	15	15	15
Mean rate of excretion (mμg. per min.)	85.0	78.9	−6.1	58.0	74.9	16.8	29.3	20.2	−9.1	23.6	31.5	7.9
Standard Error			15.6			14.3	3.6	2.1	2.9	3.2	4.5	3.4
t			0.391			1.174			3.138			2.324
Probability			>.50			>.20			<.01			<.05

For example, the diurnal decrease in excretion of norepinephrine was 6.1 mμg./min. as judged from the control days. On EST days, however, the expected diminution in rate did not occur and there was an actual increase of 16.8 mμg./min. in output. These differences for norepinephrine excretion represent means derived from a very variable group of measurements, reflected in the large standard errors tabulated, and did not prove to reach a level of statistical significance by the *t* test. In the case of epinephrine the corresponding changes were a decrease of 9.1 mμg./min. on control days and an increase of 7.9 mμg./min. on EST days. Both of these differences proved significantly different from zero at the 5 per cent level of probability.

A correct estimate of the effect of EST on epinephrine output should take into account not merely the rate of excretion in the periods immediately preceding and following EST, but also the rate that could have been expected had EST not been given. Such an estimate is then given by the difference

$$7.9 - (-9.1) = 17.0 \text{ m}\mu\text{g./min.}$$

estimated with a standard error of 4.5 mμg./min. For $(n_1 + n_2 - 2) = 29$ degrees of freedom the value of $t = 3.778$ is highly significant ($P < .01$). The effect of EST calculated in this way from both groups of subjects is shown in the last column of Table 2.

It will be noted (Table 1) that the first morning sample of urine on EST days in both groups indicated a lower rate of excretion of epinephrine than on control days. In neither group was the difference statistically significant ($P > .05$).

DISCUSSION

Changes in the metabolism of PCA in the plasma as a result of EST have attracted the attention of several groups of investigators in recent years. In fact, three studies making use of the procedure of Weil-Malherbe and Bone (16) or modifications of it have shown considerable agreement. The results of these studies are summarized qualitatively in Table 2. The present data appear to be the first to describe the effect of EST on the urinary excretion of epinephrine and norepinephrine. This ef-

TABLE 2

Comparison of the Effect of Electroshock Therapy (EST) and of Certain Drugs on Plasma and Urinary Pyrocatecholamines

Treatment	Amine	Change in Concentration in Plasma			Increase in the Rate of Excretion in the Urine (mμg./min.) Mean ± Standard Error	
		Weil-Malherbe (15)	Manger *et al.* (7)	Griswold (4)	Present Data	
Barbiturate	E	decrease				
	N	no change				
Muscle paralyzing agent	E	no effect[a]		no effect[b]		
	N	no effect		no effect		
Barbiturate plus muscle paralyzant	E		decrease[c]			
	N		decrease[c]			
Unmodified EST	E	increase		increase	17.0 ± 4.5	Group V[e]
	N	increase		increase	22.9 ± 21.2[d]	Group V[e]
EST modified by barbiturate	E	increase				
	N	no change				
EST modified by muscle paralyzant and barbiturate	E		increase		4.6 ± 10.3[d]	Group A
	N		variable		10.0 ± 25.0[d]	Group A

[a] Suxamethonium bromide used. [b] Succinylcholine chloride used. [c] Studied in 2 patients only. [d] Not statistically significant. [e] Patients received Flaxedil[R] (see text). [f] Premedication included atropine sulfate (see text).

fect has been tabulated for comparison alongside the other data in Table 2.

It can be seen that unmodified EST increases the concentration of both amines in the blood and raises their urinary output. The effect on urinary norepinephrine represents a substantial alteration in the rate, but because of the unduly high variation in the norepinephrine figures it has been impossible to adjudge the change as a statistically significant one. It may be added that norepinephrine concentrations in the plasma are similarly much more variable than those of epinephrine (4, 7, 15). The small amount of Flaxedil[R] administered to Group V patients probably does not affect the output, if one is permitted to argue this from the lack of effect of either of two other muscle paralyzing agents on the concentration of plasma PCA (Table 2). When EST is modified by the use of barbiturate, with or without muscle paralyzing agent, the epinephrine increase persists, but the increase in norepinephrine is abolished. The effect of this modified EST on the urinary output (in group A) is then very much diminished, by 73 per cent in the case of epinephrine and 56 per cent in the case of norepinephrine. The resultant mean increases attributable to administration of electroshock are too small to attain statistical significance.

The release of epinephrine from the adrenal gland probably lasts only as long as the current is flowing (15). Nevertheless, as this work shows, the brief-lasting secretion of the hormone is sufficiently large in volume to be detectable as an increase in the rate of its excretion, averaged over a 4-hour period. It is not inconceivable that a statistically significant increase in norepinephrine excretion might have been detected if a shorter period of urine collection after delivery of electroshock had been selected.

It is instructive to calculate the actual amount of "extra epinephrine" produced as a result of EST. At the rate of excretion of 17 mμg. per min. (Table 2) computed for 4 hours it is of the order of 4 μg.; this estimate is probably somewhat low, for some of the amine secreted may follow other paths of metabolism than excretion as the free compound. If Euler and Luft's esti-

mate of the extent of inactivation of infused norepinephrine in man (2) can be applied to the inactivation of epinephrine secreted under the conditions of therapeutic electroshock then the 4 μg. of free (i.e., unconjugated) epinephrine represents 120–270 μg. of amine secreted into the adrenal venous blood. This amount corresponds to a significant proportion of the epinephrine content of the adrenal gland (9) and, at this rate, repeated electroshock could be expected to deplete the medullary stores, as apparently occurs with insulin treatment (8, 12). However, the drain on adrenal stores of epinephrine is imposed only every other weekday and, furthermore, the inactivation factor deduced by Euler and Luft from studies with intravenously infused norepinephrine may overestimate the amount of epinephrine secreted physiologically in a brief and sudden burst, as it were. Actually, there is some evidence that a depletion of epinephrine stores does not occur, for Griswold found that there is no significant change in the effect of electroshock on the concentration of epinephrine in the plasma during the course of EST (4).

SUMMARY

Therapeutic electroshock in patients receiving only small doses of a muscle-relaxing drug as premedication resulted in a significant increase in the rate of urinary excretion of epinephrine. No significant change was observed in patients premedicated with atropine and a barbiturate in addition to the relaxant. The effect of electroshock on the rate of norepinephrine output was quite variable.

REFERENCES

1. Euler, U. S. von, Hellner-Björkman, S. and Orwen, I. Diurnal variations in the excretion of free and conjugated noradrenaline and adrenaline in urine from healthy subjects. Acta Physiol. Scandinav., **33:** Suppl. 118, 10–16, 1955.
2. Euler, U. S. von and Luft, R. Noradrenaline output in urine and after infusion in man. Brit. J. Pharmacol., **6:** 286–288, 1951.
3. Gellhorn, E. *Physiological Foundations of Neurology and Psychiatry.* Univ. of Minnesota Pr., Minneapolis, 1953.
4. Griswold, R. L. Plasma adrenaline and noradrenaline in electroshock therapy in man and rats. J. Appl. Physiol., **12:** 117–120, 1958.
5. Kalinowsky, L. B. and Hoch, P. H. *Shock Treatments, Psychosurgery, and other Somatic Treatments in Psychiatry.* 2nd ed. Grune & Stratton, New York, 1952.
6. Kärki, N. T. The urinary excretion of noradrenaline and adrenaline in different age groups, its diurnal variation and the effect of muscular work on it. Acta Physiol. Scandinav., **39:** Suppl. 132, 1956.
7. Manger, W. H., Schwarz, B. E., Bears, C. W., Wakim, K. G., Bollman, J. L., Peterson, M. C., and Berkson, J. Epinephrine and arterenol (norepinephrine) in mental disease. A. M. A. Arch. Neurol. & Psychiat., **78:** 396–412, 1957.
8. Pitkänen, E. Studies on the determination and excretion of adrenaline and noradrenaline in the urine. Acta Physiol. Scandinav., **38:** Suppl. 129, 1956.
9. Shepherd, D. M. and West, G. B. Noradrenaline and the suprarenal medulla. Brit. J. Pharmacol., **6:** 665–674, 1951.
10. Snedecor, G. W. *Statistical Methods.* 4th ed. Iowa State College Pr., Ames, Iowa, 1946.
11. Sourkes, T. L. and Drujan, B. D. A routine procedure for the determination of catecholamines in urine and tissues. Canad. J. Biochem. & Physiol., **35:** 711–719, 1957.
12. Sourkes, T. L., Drujan, B. D. and Curtis, G. C. In preparation.
13. Sourkes, T. L., Sloane, R. B. and Drujan, B. D. Pyrocatechol amine (catecholamine) metabolism and effects of electroconvulsive therapy. A. M. A. Arch. Neurol. & Psychiat., **78:** 204–206, 1957.
14. Sourkes, T. L., Sloane, R. B. and Drujan, B. D. Relation between the rate of excretion of pyrocatecholamines in the urine and the outcome of electroshock therapy. Confinia Neurol., In press.
15. Weil-Malherbe, H. The effect of convulsive therapy on plasma adrenaline and noradrenaline. J. Ment. Sc., **101:** 156–162, 1955.
16. Weil-Malherbe, H. and Bone, A. D. The adrenergic amines of human blood. Lancet, **264:** 974–976, 1953.